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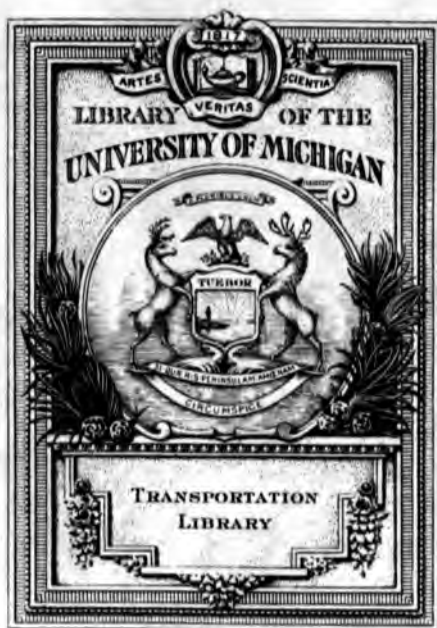
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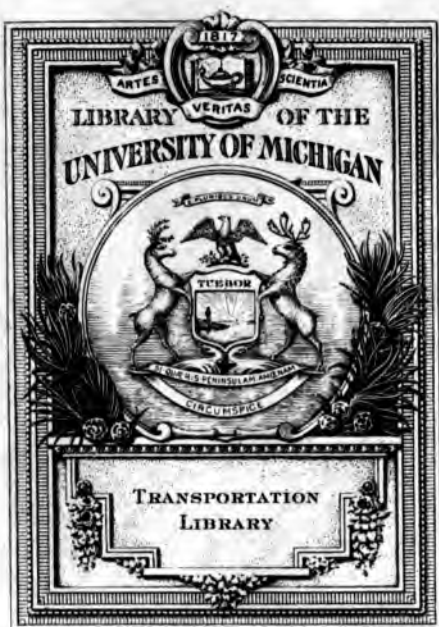
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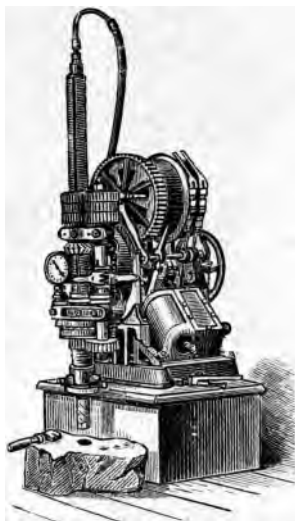
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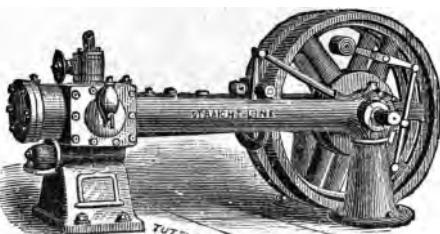
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UPPER PENINSULA

FOR THE YEAR ENDING DEC. 31, 1881.

A. P. SWINEFORD.

MINING JOURNAL.
1882.

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HISTORICAL.

The Jesuit Fathers were the first in modern times to intimate to the world the existence of native copper on the shores of Lake Superior. In the seventeenth century—more than two hundred years ago—impelled by a burning zeal for the salvation of souls, these devoted and intelligent Frenchmen, cross in hand, pushed boldly out into the savage wilderness of the great Northwest. These men were something more than mere zealots; they were good geographers, topographers and naturalists; they were apt observers, and possessed the skill and industry necessary to render their discoveries of value to mankind. Among other things, they carefully noted, as they navigated the great lake in their frail canoes, copper lying on the shores and in the possession of the superstitious savages; but it is doubtful whether these holy Fathers understood much about geology, or whence the float copper came. The Indians seem never to have made practical use of this valuable metal, but regarded the copper in their possession as something sacred. At a very late day, since mining became an industry on the lake, the same superstitious reverence prevailed. In this respect they were far inferior in intelligence to that pre-historic race known as the ancient miners.

The first published account of the existence of copper and other minerals on Lake Superior, is to be found in "Lagarde's" book, which appeared in Paris in 1636; it contained many things which would be of interest to the general reader at this time, but we shall have to be content with a few brief quotations. All the information concerning the existence of copper and other minerals on Lake Superior given by this early writer

appears to have been obtained from the Indians, and it would seem that he was not himself well versed in mineralogy. He says, referring to the south shore of the lake: "There are *mines* of copper which might be made profitable if there were inhabitants and workmen who would labor faithfully. That would be done if colonies were established. * * * About eighty or one hundred leagues from the Hurons there is a mine of copper from which Truchement Brusle showed me an ingot, on his return from a voyage to the neighboring nation." This book, it must be remembered, was published thirty years before the advent of the Jesuit Fathers, Allouez, Mesnard and Marquette, and the language of the author is such as to encourage the belief that there existed at the time to which he referred copper *mines* that were actually being wrought by the Indians, or, perhaps, by a last remnant of the "ancient miners;" otherwise why should he have used the word "mines?" Nor could he have seen an *ingot*. It is much more probable that his "mines" were undeveloped lodes, and the "ingot" a mere boulder—the ancient miners must have been extinct thousands of years before, according to archæologists. "It is," says he, "pretended, also, that near Saguenay, gold, rubies, and other precious stones are found. I am assured that, in the country of the Souriquois there are not only mines of copper, but also of steel; also certain blue transparent stones, which are as valuable as turquoises." He also says that "among the rocks they found stones covered with diamonds attached to the rocks—some of them appearing as if just from the hands of the lapidary, they were so beautiful." He was not sure, however, that they were fine, but they "were very handsome, and would write upon glass." And: "it seems that one might find mines of iron and many other minerals, if one would take the trouble of searching and go to some expense. There is an abundance of limestone and other materials required for building."

In the *Relacion de ce qui s'est passe dans le pays des Hurons*, there is much information concerning the "Lac Superieur." The *Relacion* for 1659-'60 gave an account of one of the Jesuit fathers "residing in the lake which we call Superieur." "It is enriched on all its borders by mines of lead almost pure, and of copper all refined in pieces as large as the fist, and great rocks which have whole veins of turquoises."

In a small duodecimo volume of less than two hundred pages,

published in Paris in 1640, by Pierre Boucher, the following mention of Lake Superior is made:

"There are mines of copper, tin, antimony and lead." Can it be that the author visited the tin discovery on the north shore, afterwards found and *lost again* by Detroit parties? "In Lake Superior there is a great island which is fifty leagues in circuit, in which there is a very beautiful mine of copper; it is found also in various places in large pieces all refined." Is it not probable that the "beautiful mine of copper" referred to by this writer was the ancient mine lately re-opened by the Minong company? If the works of the ancients are so clearly discernible at this late day, it is not impossible that the scene of their mining operations may, at that date—two hundred and fifty years ago—have presented more the aspect of a lately developed mine than that of one long abandoned.

In the *Relacion* for 1666-'67, in a chapter entitled, "*Journal du Voyage du Pere Claude Allouez dans le Cais 'des Outaouacs'*" are to be found these passages:

"The savages respect this lake as a divinity, and make sacrifices to it, on account, perhaps, of its magnitude, for it is two hundred leagues long and eighty leagues wide; or on account of its goodness in furnishing them with fishes, which nourish all these people where there is but little game. There are often found, beneath the water, pieces of copper all formed, and of the weight of ten or twenty pounds. I have seen them many times in the hands of the savages, and as they are superstitious, they keep them as so many divinities, or as presents from the gods beneath the water, who have given them as pledges of good fortune. On that account they keep the pieces of copper enveloped among their most precious furniture. There are some who have preserved them for more than fifty years, and others who have had them in their families from time immemorial, and cherish them as household gods.

"Some time since a large mass of copper, like a rock, was seen with the point projecting out of the water. This afforded passers by an opportunity of cutting off pieces. Nevertheless, when I went by there it was not to be seen. I believe the storms, which are here very violent and like those on the ocean, had covered the rock with sand. Our savages wished to persuade us that it was a divinity, and had disappeared, for some reason which they did not mention."

“De la Mission du Sainte Esprit a la Point de Chagaoumigon dans le Lac Tracy ou Supérieur—Chapter XI, des Proprietez et Raritez.” We find in Dr. Jackson’s report, made to the Secretary of the Interior in 1849, the following translations:

“The lake has nearly the form of a bended bow, of more than eighty leagues in length. The southern side represents the string, and a long tongue of land which springs from the south shore, and projects upwards of twenty-five leagues into the lake near to its middle, is the arrow.” (The writer, of course, refers to Keweenaw point, and his illustration of the form of the lake was apt and truthful, though he does not seem to have had an accurate knowledge of its length.) “The northern coast is bordered with frightful crags, which are the termination of that prodigious chain of mountains which take their rise at Cape Tourment, above Quebec, and extend to this place, traversing more than six hundred leagues in extent, and losing themselves at the farther extremity of the lake. There are very few islands in the lake, and they occur mostly on the northern side, near the shore. This great expanse of the waters gives room for the winds, which agitate the lake with as much violence as they do the ocean.”

On page 26, of the same work, is a chapter entitled: “Mines of Copper which are found on Lake Superior:”

“Up to the present time it was believed that these mines were found only on one or two of the islands; but since we have made a more careful inquiry we have learned from the savages some secrets which they were unwilling to reveal. It was necessary to use much address in order to draw out of them the knowledge, and to discriminate between the truth and falsehood. We will not warrant, however, all we learned from their simple statements, since we shall be able to speak with more certainty when we have visited the places themselves, which we count on doing this summer, when we shall go to find the ‘wandering sheep’ in all quarters of this great lake. The first place where copper occurs in abundance, after going above the Sault, is on an island about forty or fifty leagues therefrom, near the north shore, opposite a place called Missipiconatong.

“The savages say it is a floating island, which is sometimes far off and sometimes near, according as the winds move it, driving it sometimes one way and sometimes another. They add that, a long time ago, four Indians accidentally went there,

being lost in a fog, with which this island is almost always surrounded. It was long before they had any trade with the French, and they had no kettles or hatchets. Wishing to cook some food, they made use of their usual method, taking stones which they picked up on the shore, heating them in the fire, and throwing them into a bark trough full of water, in order to make it boil, and by this operation cook their meat. As they took up the stones they found they were nearly all of them pure copper. After having partaken of their meal they thought of embarking, fearing to remain lest the lynxes and the rabbits, which are in the place as large as dogs, would come and eat up their provisions, and even their canoe. Before leaving they collected a quantity of these stones, both large and small ones, and even some sheets of copper. But they had not gone far from the shore before a loud voice was heard, saying in anger—'Who are these robbers who have stolen the cradles and playthings of my children?' The sheets of copper were the cradles, for the Indians make them of one or two pieces of wood—a flat piece of bark with a hoop over one end—the child being swathed and bound upon the flat piece. The little pieces of copper which they took were the playthings, such pebbles being used by Indian children for a like purpose. This voice greatly alarmed them, not knowing what it could be. One said to the others, it is thunder, because there are frequent storms there; others said, it is a certain genii whom they call Missibizi, who is reputed among these people to be the god of the waters, as Neptune was among the pagans; others said that it came from Memogovissiousis—that is to say, seamen, similar to the famous Tritons, or to the syrens, which live always in the water, with their long hair reaching to their waists. One of our savages said he had seen one in the water; nevertheless, he must have merely imagined that he did. However, this voice so terrified them that one of these voyageurs died before they reached land. Shortly after a second one of them expired; then a third; so that only one of them remained, who, reaching home, told all that had taken place, and died shortly afterwards. The timid and superstitious savages have never since dared to go there for fear of losing their lives, believing that there are certain genii who kill those who land there; and within the memory of man no one has been known who has set foot on that island, or even coasted along its shores, although the island is within sight,

and even the trees are visible upon another island called Achemikonan.

"There is both truth and error in this story, and this is probably the explanation: These savages were poisoned by the water which they boiled with red hot copper, which by the intensity of its heat gave off its poison, etc. It is not a poison which acts immediately, and on one as soon as it will on another, as happened in the case of these Indians. It may be that when they were taken ill, they more readily imagined they heard a voice; perhaps an echo, such as are very common among the rocks which border this island; or, perhaps, they made this fable since, not knowing to what to attribute the death of these Indians. When they said it was a floating island it is probable they may have been misled by the vapors which surround it; they being rarified or condensed by the variable action of the sun's rays, made the island appear sometimes near and sometimes far off. It is certain, however, that it is a common belief among the Indians that there is a great abundance of copper on the island; but they dare not go there. We hope to begin our discoveries upon it this summer.

"Advancing to a place called the Grand Anse, (Great Bay,) we meet with an island which is celebrated for the metal which is found there, and for the thunder which takes place, because they say it always thunders there, (Thunder Cape.) But further towards the west, on the same north shore, is the island most famous for copper, called Minong, (the good place,) Isle Royale. This island is twenty-five leagues in length; it is seven leagues from the main land, and sixty from the head of the lake. Nearly all around the island, on the water's edge, pieces of copper are found mixed with pebbles, but especially on the side which is opposite the south, in principally a certain bay which is near the north-east exposure to the great lake. There are shores *'tous escarpez de terre glaize,'* and there are seen several beds or layers of copper, one over the other, separated or divided by other beds of earth or rocks. In the water is seen copper sand, and one can take up in spoons grains of the metal big as an acorn, and others as fine as sand. This island is almost surrounded with islets, which are said to be composed of copper, and they are met with even to the main land on the north. Advancing to the head of the lake, and returning one day's journey, by the south coast, there is seen on the edge of the water a rock of copper which

weighs 700 or 800 pounds, and is so hard that steel can hardly cut it; but when it is heated it cuts as easily as lead. Near Point Chagaoumigong, where a mission was established, (Lapointe,) rocks of copper and plates of the same metal were found on the shores of the islands.

"Last spring we bought of the savages a sheet of pure copper two feet square, which weighed more than 100 pounds. We do not believe, however, that the mines are found on these islands, but that the copper was probably brought from Minong, or from other islands by floating ice, or over the bottom of the lake by the impetuous winds, which are very violent, particularly when they come from the northeast.

"Returning still towards the mouth of the lake, following the coast on the south, at twenty leagues from the place last mentioned, we enter the river called Nantounagan (Ontonagon), on which is seen an eminence where stones and copper fall into the water, or upon the earth; they are readily found. Three years since, we received a piece which was brought from this place which weighed a hundred pounds, and we sent it to M. Talon, at Quebec. It is not certain exactly where this was taken from; some think it was taken from the river; others that it was from near the lake and dug up from the soil.

"Proceeding still further, we come to the long point of land which we have compared to the arrow of the bow (Keweenaw Point); at the extremity of this there is a small island which is said to be only six feet square, and all copper.

"We are assured that copper is found at various places along the southern shore of the lake. All the information we obtained from others it is not necessary for us to detail; but it seems necessary that more exact researches should be made, and this is what we shall endeavor to effect. If God prospers our enterprise, we shall speak next year with more certainty and knowledge."

The *Relation* of 1670-'71 contains the remarks of Pere Ablon. On page 91, he gives an account of the copper mines: "We would remark, by the way, that copper is found in all parts of this lake, although we have not as yet sufficiently exact knowledge, for want of thorough explorations; nevertheless, the plates of this metal which we have seen weigh each a hundred or two hundred pounds, and much more. The great rock of copper of 700 or 800 pounds, and which all the trav-

elers saw near the head of the lake, besides a quantity of pieces which are found near the shore in various places, seem not to permit us to doubt that there are somewhere the parent mines, which have not been discovered."

These accounts are from the letters or reports of the Jesuit missionaries; Rene Mesnard having been, so far as is known, the first white man who visited this region. He left Quebec on the 28th of August, 1660, and on the 15th of October of the same year reached the head of Keweenaw Bay (L'Anse), having coasted along the south shore in a frail birch-bark canoe. Spending the winter among the Indians at that point, the following spring, accompanied by only a single Indian, he started for Chaquamegon Bay. He took the route through Portage Lake; while the Indian was carrying the canoe across the Portage to Lake Superior the good father wandered into the woods, and was never seen again. That is the story told by the Indian; but it is far more probable that he fell a victim to Indian treachery. Father Claude Allouez was the next to follow, reaching Lapointe on the first of October, 1665, where he established a mission. After him came James Marquette and Claude Dablon, who established a mission at Sault Ste. Marie, in 1668. The first map of Lake Superior was drawn by Allouez and Marquette in 1668, and was published in 1672. They named the lake "*Lac Tracy Ou Supérieur*."

In 1688, Baron Le Houtan published a book of travels in Canada. He had followed in the footsteps of Allouez, and describes many of the objects spoken of by the latter. After describing the lake and the people who dwelt upon its shores, he closes by saying that "upon it we also find copper *mines*, the metal of which is so firm and plentiful that there is not a seventh part base from the ore."

In 1721, De Charlevoix visited Lake Superior and crossed from the falls of the St. Louis river to the Mississippi, exploring that river to the Gulf of Mexico. His published account is much more minute than that given by those who preceded him, entering, as he does, more into details concerning the resources of the country through which he passed. Speaking of Lake Superior, he says: "Large pieces of copper are found in some places on its banks, and around some of the islands, which are still the objects of a superstitious worship among the Indians. They look upon them with veneration, as if they were the pres-

ents of those gods who dwell under the waters ; they collect the smallest fragments, which they preserve, without, however, making any use of them. They say that formerly a large rock of this metal was to be seen elevated a considerable height above the surface of the water, and as it has now disappeared, they pretend the gods have carried it elsewhere ; but there is good reason to believe that in process of time the waves of the lake have covered it entirely with sand and slime ; and it is certain that in several places pretty large quantities of this metal have been discovered without being obliged to dig very deep. During the course of my first voyage to this country, I was acquainted with one of our order (the Jesuits) who had been formerly a goldsmith, and who, while he was at the mission of *Sault De Ste. Marie*, used to search for this metal, and made candle-sticks, crosses and censers of it ; for this copper is often to be met with almost pure."

In 1765 Capt. Jonathan Carver, starting from Mackinac, coasted to Green Bay in company with some fur traders, then ascended the Fox river through Lake Winnebago, to the portage between that river and the Wisconsin, and thence descended the latter to the Mississippi. From there he proceeded up the Mississippi to St. Anthony, where he remained with the Indians until the spring of 1767, when he retraced his steps to the Chippewa river, and made his way up that stream to an Indian village of the same name. From there he crossed over to a head branch of the St. Croix, descended this branch to a fork, and then ascended another to its source. On both of these rivers, he says, he discovered "*mines of virgin copper, which was as fine as that found in any other country.*" From the head waters of the St. Croix his route was to the sources of a river which he named Goddard's River, and which was most probably the Bois Brule, which he descended to Lake Superior. He says in his publication that the Ontonagon river is "remarkable for the abundance of virgin copper that is found on and near its banks, a metal which is met with also in several other places on this coast." "I observed," says he, "that many of the small islands, particularly those on the eastern shore, were covered with copper ore." His book was, justly, perhaps, regarded by many as a second edition of Gulliver's Travels, and it is certain that the subsequent explorations of the country through which he passed failed to

confirm the truth of many of his statements, which appear to have been merely the creations of a vivid imagination. That he visited the places he describes there is no good reason to doubt; that he discovered "*mines* of copper on the Chippewa or St. Croix no one is now willing to believe. He may have seen a few bowlders, and from their presence took it for granted that they came from "*mines*" near by, but which really had no existence. Such bowlders are occasionally found far removed from any known lodes of the ore or metal, but their only significance is to confirm belief in the glacial theory. However, the publication of his book of travels produced such a sensation in England that a copper company was at once formed for the purpose of developing the mines Carver claimed to have discovered. This was in 1770. The company engaged in their arduous and doubtful enterprise with great spirit and enthusiasm.

The details of the operations and failure of this company have been preserved in a book published by Alexander Henry, entitled "*Travels and Adventures in Canada and the Indian Territories between the Years 1760 and 1776.*" Henry was the earliest English traveler who visited the shores of Lake Superior of whom we have any account. Mr. Henry was an adventurous gentleman. He escaped the dread fate of others at the Mackinac massacre; was an Indian captive and carried into the Rocky mountains; was a fur trader, and, after the ancient miner, was the first mine superintendent on the lake. He was also the historian of this first mining enterprise, and in his book gives an account of a trip made by him along the south shore of the lake in 1765, which shows that he was here in advance of Carver. He says:

"On the 19th of August, 1765, we reached the mouth of the Ontonagon river, one of the largest on the south side of the lake. At the mouth was an Indian village, and three leagues above a fall, at the foot of which sturgeon at this season were so abundant that a month's subsistence for a regiment could have been taken in a few hours. But I found this river chiefly remarkable for the abundance of copper which is on its banks and its neighborhood, and of which the reputation is at present more generally spread than it was at the time of my first visit.

"The copper presented itself to the eye in masses of various weight. The Indians showed me one of twenty pounds. They

were used to manufacture this metal into spoons and bracelets for themselves. In the perfect state in which they found it it required nothing but to beat it into shape. The Pawatie, or Iron river, enters the lake to the westward of the Ontonagon, and hence, as is pretended, *silver was found while the country was in possession of the French.*

"On my way back to Michilmackinac, I encamped a second time at the mouth of the Ontonagon river, and now took the opportunity of going ten miles up the river with Indian guides. The object for which I most expressly went, and to which I had the satisfaction of being led, was a mass of copper of the weight, according to my estimate, of no less than five tons. Such was its pure and malleable state, that with an axe I was able to cut off a portion weighing a hundred pounds. On viewing the surrounding surface, I conjectured that the mass, at some period or other, had rolled from the side of a lofty hill which rises at its back."

In 1770 Henry built a sloop of forty tons, at Point Aux Pins, and in the spring of 1771, with a party of miners, sailed on a voyage of discovery around the lake, finally landing at the mouth of the Ontonagon, in the fall of that year, where they built a house. Having pitched upon a spot for the commencement of operations, and arranged everything for the accommodation of the miners during the winter, he returned to the Sault. He says:

"Early in the spring of 1772, we sent a boat load of provisions, but it came back on the 20th of June, bringing with it, to our surprise, the whole establishment of miners. They reported that in the course of the winter they had penetrated into the face of the hill, but on the arrival of a thaw, the clay on which, because of its stiffness, they had relied, and neglected to secure by proper supporters, had fallen in; that from the detached masses of metal, which to the last had daily presented themselves, they supposed there might ultimately be reached a body of the same; but they could form no conjecture of its distance, except that it was probably so far off as not to be pursued without sinking an air shaft; and, lastly, that the work would require the hands of more men than could be fed, in the actual state of the country.

"Here our operations ended. The metal was probably within our reach, but if we had found it, the expense of carrying it to

Montreal must have exceeded its marketable value. It was never for the exportation of copper that our company was formed, but always with a view to the silver, which it was hoped the ores, whether of *copper* or *lead*, might in sufficient quantity contain."

According to Dr. Houghton, "Henry began his operations at Miner's river, in the upper gray sandstone; and, also, on Ontonagon river, near the mass of native copper, at which point a shaft was commenced and carried about forty feet through a reddish clay, at which point the red sand rock was reached." Why Henry failed is obvious to any practical miner of to-day.

Later on, from time to time, scientific and treaty making expeditions were conducted up the chain of lakes, and thence across to the head waters of the Mississippi. Governor Cass, Mr. Schoolcraft, Colonel Long, U. S. A., and others, men eminent in affairs and scientific acumen, early in the present century, gave to the world in graceful and instructive narratives the sum of their observations and discoveries.

In an humbler sphere, perhaps with more selfish aims, the great fur trading companies were largely instrumental in bringing the lake region into notice. The Hudson Bay, Northwest and American fur companies had extended their almost regal sway from the lakes to the Polar regions, from the Atlantic to the Pacific ocean. Penetrating the great trackless wilderness, ransacking those boundless solitudes, the contemplation of which now fills the mind with wonder and awe, the hardy hunters and trappers, the *voyageurs* and *couriers du bois*, pursued their adventurous calling. Neither heat nor cold; nor toil, nor hunger, nor savage foe, nor mountain heights, nor boundless plains, nor swollen torrents, nor tempestuous lakes, nor labyrinthian swamps stopped these enduring continental rangers. The practical knowledge of the countries traversed acquired by these men of the woods was great, and although the policy of the fur trading monopolies was close and repressive, yet it was not possible to wholly prevent some portion of that knowledge concerning those vast, richly endowed solitudes reaching the outer world. At a later day, these *voyageurs*—of the rank and file—became useful aids in the exploration and settlement of the Upper Peninsula. Many of our respected French citizens, of to-day, were of this class.

Notwithstanding the very considerable measure of knowledge

gathered from all of the above-mentioned sources, yet it must be confessed that even at so late a period as 1840, that knowledge seems not to have spread far and wide. The general public regarded the great Northwest as through a glass, darkly. We extract a paragraph or two from the *Detroit Free Press*, to illustrate this point; these extracts also fix the date of the first bill for an appropriation for the Ste. Marie ship canal:

WASHINGTON, April 21st, 1840.

This day in the senate, the bill granting to the State of Michigan 100,000 acres of land to aid her in the construction of a canal around the falls of Ste. Marie, came up again on third reading. Mr. Norvel and others advocated the bill. Mr. Clay, of Kentucky, took occasion to speak of the work as one beyond the range of the remotest settlements in the United States, or in the moon. Senator Norvel advocated the bill mainly on the ground that the completion of the canal would stimulate the fisheries of Lake Superior, estimated to be worth one million dollars per annum. The honorable Senator added, "In the country bordering on the southern shore of Lake Superior copper ore and other minerals are believed to exist in abundance."

It remained for Dr. Douglass Houghton, the first and ablest state geologist of Michigan, to make such careful exploration of the south shore of Lake Superior as to clear up the mists of tradition, illuminate the subject and attract the attention of the people of the United States and of Europe to the new mineral fields of North America. Dr. H. first visited Lake Superior in 1830, with Gen. Cass. While at the mouth of the Ontonagon, the whole party went up the river to see the famous copper rock referred to by Henry. The year after he came back with the Schoolcraft expedition, which was sent out by the general government for the purpose of ascertaining the sources of the Mississippi. Having prepared himself with chisels, he again visited the copper rock, and cut off and took away some specimens, which are still retained in the family. In cutting off the specimens he broke two of his chisels, which he left on top of the rock. While making his first geological survey in 1840, he again visited the rock, and found his broken chisels just as he had left them, nine years before. His first report to the Legislature, in 1841, after ten years of explorative toil, produced a great impression. In 1844, Dr. Houghton took a contract from the general government to make the linear surveys on the lands bordering Lake Superior on the south, *combining them with the geological survey*. This system was his own—the rapid, careful, minute manner in which the surveys were conducted under it, is the best evidence of its wisdom.

Dr. Houghton was ably and faithfully assisted in his surveys by Messrs. Wm. A. Burt, Bela Hubbard, C. C. Douglass, Wm. Ives, S. W. Hill, Mr. Higgins and Jacob Houghton, Jr.

In the autumn of 1845, while on his last expedition for the season, when approaching Eagle river in a small boat, a sudden storm arose, and before his frail bark could find a safe landing place, on the rock-bound shore, it was capsized, and all on board perished, save one man. The whole country was shocked at the announcement of this tragical event, and science mourned for one of its brightest ornaments. Aside from personal considerations, his death was to be deplored; many of his field notes were lost with him, and the treasures of his well-stored mind were irreparably beyond recall. His final report, which he was prepared to make, could never be given to the world. Mr. Bela Hubbard completed the contract which Dr. Houghton had entered into with the United States Government. Mr. Hubbard and Wm. A. Burt, Esq., subsequently made interesting and valuable sub-reports of their operations.

Dr. Houghton was small in stature, blue-eyed, with light hair; temperament exceedingly active and nervous. He was hardy, bold and daring, even to rashness; he endured the toil, hardships and privations of a life in the rough wilderness with unconquerable resolution. He was a leader among men. Said one of our upper peninsula representatives in an address before the members of the legislature of 1875: "Here let us pause—for DOUGLASS HOUGHTON is a name which no citizen of Michigan, and certainly no Lake Superior man, can pass without a tribute; unspoken, perhaps, but none the less stirring, deep and pure in the bottom of his heart. The world has now but just turned from the pageant which followed to an illustrious tomb, the scarred and weather-beaten frame of that great man, Dr. Livingstone, who gave up his life to his God, humbly kneeling by his rough couch in the wilds of Africa, where no other white man's foot had ever trod, in magnificent solitude. We have here no enormous London, no rich and cultured people, bowing in enthusiasm before the thrones of intellect, science, genius and heroism; no titled hereditary lords and sovereigns, in funereal train; no vast and somber monumental pile, where rest in peace the ashes of the mighty dead. We are a rough, practical, money-making race; seldom in our busy life can *we* pause to ponder on the goodness of a by-gone friend, and we shudder to think how soon

the stream of life will close over our heads after we too have followed. But we have great, warm, working, western hearts, which the icy waters that were *his* winding sheet cannot chill, and they shall be our Westminster Abbey—DOUGLASS HOUGHTON'S mausoleum." His remains were not discovered until the spring of 1846, when they were taken to Detroit by his brother, Jacob Houghton, Jr., for interment.

In the year 1846-7, Dr. Jackson was commissioned by the United States Government to make further geological surveys, and visited the lake with a large party of interesting young men. He spent some time in visiting the working mines and in collecting mineralogical specimens. He employed as assistants Messrs. Foster and Whitney, who had been in the country one or two years—acting as geologists, we believe, for private exploring parties. About mid-summer, Dr. Jackson sailed for Isle Royale, accompanied by Professor Foster, John H. Mullett, surveyor, and others. The object of the expedition was a brief examination of the island, but as no vessel came for the distinguished party, it was detained there many weeks. Their observations were confined to the immediate shores of Rock Harbor, and a study of the piscatorial inhabitants of that charming inlet.

In 1848, Doctor Jackson was superseded by Messrs. Foster and Whitney, and the valuable report which they gave to the world is evidence enough of the able manner in which they discharged their duties. In 1873, Professor Foster, LL.D., published an interesting work entitled *Pre-Historic Races of the United States of America*. He died in Chicago in 1874. Professor Whitney has since become eminent as state geologist of California.

In the summer of 1842, a treaty was made with the Chipewa Indians, by Robert Stewart, which was ratified by the Senate at the next session of Congress. By this treaty, all the country east of Fond du Lac, including the islands in Lake Superior not previously acquired, was ceded to the United States. Immediately after the ratification of this treaty, applications were made for permits to explore and dig for copper ore within the limits of the territory thus acquired. Hon. David Henshaw, of Boston, was then Secretary of War, and he not only gave these applications favorable consideration, but through his influence Boston capitalists were enlisted in the prosecution of the first mining enterprises, and ever since then Boston has been

largely identified with the development of the Lake Superior mining interest.

THE IRON MINES.

It is now thirty-six years since the first discovery of workable deposits of merchantable iron ore in this region. That discovery was made by S. T. Carr and E. S. Rockwell, who were members of a party which came to Lake Superior with P. M. Everett, Esq., in the summer of 1845, their discovery being afterwards developed into what is now known as the Jackson mine, situated within the corporate limits of the city of Negaunee. The first ore was mined in 1846, and the first iron ever made from upper peninsula ore (except a small bar made in a blacksmith's forge) was turned out at the old Jackson bloomery, which was situated a few miles east of Negaunee, on the Carp River, in February, 1848. The first shipment of ore from the upper peninsula comprised about five tons, which was sent to Newcastle, Pa., by A. L. Crawford, Esq., then, as now, proprietor of large iron works at that place. A test of these five tons served to attract the attention of Pennsylvania and Ohio iron-masters to this new field of supply for their furnaces; but, nevertheless, comparatively little was accomplished towards its development until, in 1852, about seventy tons of Jackson ore was sent to the "Old Clay" furnace, at Sharon, Pa., which had the honor of making the first pig iron from Lake Superior ore. Regular shipments to lower lake ports did not commence, however, until the summer of 1855, in which year the St. Mary's Falls Ship Canal was so far completed as to afford an outlet to the lower lakes. From June, 1855, therefore, dates the actual history of iron mining in the upper peninsula, though some thousands of tons of ore had been mined and manufactured into blooms at the Jackson, Forest, Collins and Marquette forges previous to that date. The first ore was hauled to the lakeside at Marquette in wagons, over a rough wagon road, until the completion of a plank road in 1856, which was subsequently converted into a tram-way, this being in turn superseded by a railroad (now a part of the Marquette, Hough-

ton & Ontonagon,) which was completed to the Jackson and Cleveland mines in 1857. Previous to the completion of the railway to those mines, there had been shipped to; and smelted at, the three forges referred to 52,000 tons of ore, and the primitive condition of the mines, together with the uncertainty of the market at that early day may be inferred from the fact that the entire output of the district in 1858 was only 22,000 tons. This product was increased to 68,832 tons in 1859, and when, in 1860, a product of over 100,000 tons was achieved, those interested in the development of the region began to prophesy future results which, though wild and visionary they may have then been considered by many, have since been more than realized. In 1860 the entire aggregate production of the district had reached 348,074 tons, an annual product of 200,000 tons not being arrived at until 1864. Since then, the annual product has been steadily increased until we have to report the enormous output of 2,336,335 gross tons in 1881—to be still further increased to nearly, if not quite, three million tons in 1882.

Having given a history of each particular iron mine in our last annual publication, we shall content ourself with a brief review of their present condition and prospects, in the following pages:

THE CLEVELAND MINE,

the second oldest in the district, and the very oldest, so far as lake shipments are concerned, came to the front last year with a larger product than ever before. The fact that this old mine should, in the thirtieth year of its existence, and after having added over two million tons of first-class ore, present such a magnificent array of figures is the best evidence that can be adduced in support of the oft-repeated assertion that the iron ore deposits of Lake Superior are practically inexhaustible. This evidence may be further strengthened by an expression of the well-founded belief—a belief that is justified by the present outlook as well as by past results—that none of the old mines, (excepting, possibly, the Jackson,) have yet reached their maximum of production, and that their yield for the next thirty years will certainly exceed that of the thirty years embraced in

the following table showing the annual product of the Cleveland during that period:

	<i>Gross Tons.</i>
1852-4.....	3,000
1855.....	1,449
1856.....	6,343
1857.....	13,204
1858.....	909
1859.....	15,787
1860.....	40,091
1861.....	11,795
1862.....	40,364
1863.....	46,842
1864.....	44,959
1865.....	33,355
1866.....	42,680
1867.....	75,864
1868.....	102,112
1869.....	106,133
1870.....	132,884
1871.....	142,658
1872.....	151,724
1873.....	133,265
1874.....	105,858
1875.....	129,881
1876.....	146,393
1877.....	152,188
1878.....	152,787
1879.....	131,167
1880.....	212,748
1881.....	198,569

Total..... 2,381,959

In the above table we have included the product of the mine until last year known as the Cleveland Hematite, which was leased to Robert Nelson, and by him opened in 1876, and worked as a separate mine until last May, when he surrendered his lease to the company for a valuable consideration. The total amount of shipments thus added to those of the Cleveland mine proper is 60,562 tons, and the apparent discrepancy to be found in the statement that the Cleveland mined more ore last year than in 1880 while the table shows differently, is accounted for by the fact that 22,949 tons of Cleveland Hematite are included in the 1880 product, and only 7,667 tons in the total product of last year. It is true, the increase in the product of the "Old Cleveland," thus to be arrived at, was comparatively small, but at the same time large enough to warrant all that is said in the

beginning of this paper; the mine is not only holding her own, but gives ample promise of being able to do so for a long series of years to come.

During the past year mine work has been prosecuted in most of the old pits, though three of the smaller ones have been abandoned since our last report. In the Incline pit the stopes have been driven forward 125 feet, and 15 feet of the bottom next to the rock-crossing is now being taken up. At this last point the pillars of ore left standing are now 65 feet high, and, judging from the angle of the foot-wall, it is safe to say there is still 15 feet of ore remaining in the floor. The vein, however, is growing smaller further ahead, and in the present stopes, and is gradually approaching the surface towards the north-west. Guessing at the proper scientific expression we should say that the miners appear to be nearing an anti-clinal axis of the vein, and that it will soon be found dipping in the opposite direction—at the present time they are following it towards the surface, and one of two things is certain—it either takes another fold downward at no very considerable distance ahead of the present stopes, or else exhausts itself near the surface—the first proposition is far more likely to be the correct one, since it is corroborated by the developments made by the diamond drill far in advance of the present ore breasts, and to which reference will be made further along.

The No. 3 workings show less ore in sight than at the date of our last annual review. That there will be a gradual and very perceptible improvement in the near future, is, however, rendered certain by the fact that B drill hole, which is at least 200 feet in advance of the present working-face, shows 40 feet of clean ore, making ample allowance for the dip of the vein. This drill hole struck the ore at a depth of 350 feet from the surface, which depth, taking the dip of the vein into consideration, about corresponds with that of the underground workings, and proves conclusively that both are in the same vein, and that a gradual, if not speedy, enlargement of the ore body may be confidently looked for. This is further proved by the fact that the New York mine has been worked down to the line between the two properties for a distance of 180 feet in advance of the Cleveland workings, all along which line there is to be seen from 35 to 40 feet of ore.

The saw-mill pit looks badly from the fact that the ore in

the bottom has almost entirely pinched out. A new vein which promises well has, however, been found on the foot-wall side, into which an 80-foot shaft has been sunk, 11 feet of which is in ore. 'At the same time a drill is at work testing the ground at a lower depth.

Nos. 1, 9 and 10 have been abandoned, but the small product for which they were formerly counted on will scarcely be missed, in view of the new finds soon to be developed elsewhere on the company's tract. It is more than probable, however, that they will receive some attention in the future, if in no other way than by being more thoroughly explored with the aid of the diamond drill.

Nos. 4 and 5 are working about the same as last year, and have about the same show of ore. No. 6 is now regarded as a part of the Incline mine, and no special reference to it is necessary.

At what was formerly known as the Cleveland Hematite most of the work done since the company took possession has been of a preparatory character, carried on with more regard to economical mining in the future than for present product. Two shafts have been sunk, one of which, on the hanging-wall side, struck the ore at a depth of 130 feet from the surface. This shaft is now 170 feet in depth, the last 40 feet being all the way in ore. From the bottom drifts have been driven along the foot-wall about 85 feet in opposite directions—170 feet in all—showing clean ore all the way. Another shaft (No. 3) 160 feet deep is located in the rock-crossing referred to in the MINING JOURNAL's last report, 112 feet from the top of which a drift has been run into the ore. A similar drift is now being made from the bottom of the shaft into the ore. These two shafts will be connected by drifts from the bottom, and through this system of underground work it is designed to reach the ore in the three triangular lenses, which, as far as is at present known, constitute the available deposits in this quarter. The ore is a very soft hematite, and the timbers, which will be required to support the walls, and which must be put in as fast as the ore is removed, will constitute a very material portion of the expense account. The deposit appears to be of goodly proportions, and superintendent Bacon, who is more apt to err in being too conservative than otherwise, estimates that there is at least 40,000 tons of ore above the present drifts. The same

machinery is used for hoisting, but a large plant from the old mine will take its place early in the coming season.

The new developments of the past year have added largely to the value of the Cleveland, already one of the largest mining properties in the district. The diamond drill had previously proved the existence of large ore bodies far in advance of, and towards which the large stopes in the Incline and No. 3 pits are directly trending, and which assured beyond the possibility of a doubt many years of profitable production. More recently seven drill holes, on higher ground, in the neighborhood of the M., H. & O. Railroad round-house, on the south side of the main track of the railway, and covering an area of 175x550 feet, showed 56, 52, 10, 23, 17, and 20 feet of ore, respectively, the seventh being stopped in ore, owing to the caving in of the hole above. These drill holes, the first of which was completed soon after our last report was printed, prove the existence at this point of what promises to be the largest body of ore ever discovered on the Cleveland tract. This, it must be remembered, is a "new find," of which nothing whatever was known a year ago, and in which no mining has yet been done—a find which, large as it is, yet remains to be added to the productive capacity of a mine already yielding an annual product of 200,000 tons. To reach this deposit advantageously two vertical shafts, 13 feet square inside the timbers, will be sunk, one to a depth of 320 feet, and the other 90 feet. The first will strike the ore at a depth of 253 feet and the other at 61, the ore within the area stated above, as shown by the diamond drill, lying at depths varying from 60 to 400 feet. One of these shafts, on both of which work preparatory to sinking has been commenced, will be completed in May, but it is calculated that it will take at least a year and a half to reach the ore in the other. These shafts will be large enough to afford room for double skip-roads, air-pipes and plunger pumps, and are made square so that the skip-roads can be turned in any direction that may be necessary to meet the requirements of the mine when it is opened. A new and elaborate hoisting plant will be required and will be ordered in due season, though probably not before the middle of the summer.

Two of Bullock's diamond drills are kept constantly at work exploring new ground, not one-third of the company's territory within the limits of the city of Ishpeming having yet been

explored. Indeed, it is an open question when any given piece of ground *has* been fully explored. The underground workings, where explorations had previously been made, show that even the diamond drill is not infallible, or rather that it may frequently bore through barren ground and yet pass within a few feet of the ore. It is therefore not unlikely that ore may yet be found in territory that has heretofore been perforated in places by the drill—at all events the Cleveland management will leave no hole unbored where there is the least prospect that satisfactory results may follow.

The only building improvement of any importance made at the Cleveland within the last year is a large new stone engine house, located near the old No. 1, between the Incline and No. 3 pits, in which is located a new pumping plant, which consists of one 5x14 boiler and one 20x30 engine. This machinery is designed to pump the water from all the pits now working, and also from the new shafts south of the railroad, whenever the latter shall require it.

The mining force is about the same as last year. Capt. Bacon remains in charge as superintendent, and if the truth must be told—and the MINING JOURNAL never minces it—is without fault in his chosen vocation, except that he is “too utterly too” conservative to meet the requirements of anything or anybody, except the best interests of the company whose faithful servant he is. We mention this as a prelude to the statement that the MINING JOURNAL alone must be accepted as authority for the assertion that the product of the Cleveland mine the present year, barring accidents, of course, will equal, if it does not exceed, that of 1881.

THE LAKE SUPERIOR MINE,

while one of the oldest, yet enjoys the distinction of having last year achieved the largest product ever reported by any one mine in America, and by which she still further widened the difference in her favor in the amount of aggregate product during the thirty years' history of iron mining on Lake Superior. The first shipments were made in 1858, since which time the annual product has been as follows:

	<i>Gross Tons.</i>
1858.....	4,658
1859.....	24,668
1860.....	33,015
1861.....	25,195
1862.....	37,709
1863.....	78,976
1864.....	86,763
1865.....	50,201
1866.....	68,002
1867.....	119,935
1868.....	105,745
1869.....	131,343
1870.....	166,582
1871.....	158,047
1872.....	185,070
1873.....	158,078
1874.....	114,074
1875.....	129,339
1876.....	111,766
1877.....	127,349
1878.....	109,674
1879.....	173,938
1880.....	204,094
1881.....	282,235
Total.....	2,666,456

The immense product of 1881, it is proper to say, however, does not by any means fully indicate the actual productive capacity of the mine; one level which had been prepared for mining was left wholly unbroken during the whole season of navigation last summer, for the want of the necessary hoisting machinery, which has now been placed in position, and to which further reference will be made in the closing paragraph of this paper. It is safe to say that had it been possible to raise the ore to the surface, the level referred to would have contributed a product sufficiently large to increase the grand total for the year to at least 300,000 gross tons. We have no intimation from the management as to the probable output the present year, but in view of the fact that a marked improvement is noticeable in all the principal pits, we can see nothing, if there be a demand for it, to prevent a realization of the figures which but for a lack of machinery could have been attained in 1881. In other words, we shall not be in the least surprised if this famous mine should close the coming season with a product of 300,000 gross tons.

Since our last annual review the entire roof has been taken

off the east chamber at A shaft, and that of the west chamber is now being stripped preparatory to its removal. The roof of the last mentioned chamber constitutes a body of ore 50 feet wide, 115 feet long and 20 feet thick, all of which will be taken out the present year. The shaft is now down 140 feet, on its way to the deposit shown by the drill hole in the base ball ground, the level of which it will reach in a distance of about 250 feet from the bottom of the old west chamber. When this level is reached, a drift will be run from the bottom of the shaft to the ore. Two drill holes from the shaft, one at an angle of 10 degrees from the horizontal, and the other at an angle of 34 degrees, seem to have further proved the correctness of the fold theory, the first having cut about five feet of ore, the dip of which is towards the base ball ground deposit. The last hole was in the supposed foot-wall where no ore was expected, and none found; the shaft is going down on the line of this last mentioned drill hole. The deposit under the base ball ground, which this shaft with connecting drift will tap, is shown by the diamond drill to be at least 35 feet thick, making due allowance for the dip. A hole is now being drilled just east of the shaft, to test the ground in that direction. The diamond drill will likewise be employed in testing the ground south of the railway track, and with the hope of finding an extension across the line of the large body of ore recently discovered by the Cleveland company near the round house.

* At No. 1 connection has been made with No. 2, on the 280-foot level, while the shaft has been dropped 40 feet deeper—or to the 320-foot level. On this level the miners are stoping westward in a vein or lens of the average thickness of from 20 to 25 feet. This lens lies on the north foot-wall, and looks much better than at this time last year as to size, while the quality remains unchanged. East of the shaft there is a pit which has no connection with the vein to the west, and from which considerable second class ore has been, and can still be, mined. The ore west of the shaft is all a first class quality of the variety known as slate.

In No. 2 all the ore above the 280-foot level has been practically mined out. North and west of No. 2 skip-road there was on this level a body of ore, irregular in shape, which averaged 33 feet in width, and which was 75 feet long at its greatest length. The size of this ore body holds good on the next lower,

or 320-foot level. The lens lying on the south wall has been worked out over a length of 370 feet, on the 280-foot level, and the two intervening lenses 320 and 160 feet, respectively. These lenses appear to be gaining in width, or thickness, and are gradually approaching each other in sinking. On the 280-foot level the distance between the so-called north and south foot-walls is 120 feet; on the 320-foot level they appear to be only 95 feet apart. On the 320-foot level the ore has been stoped out over a length of 230 feet west of the shaft in the south vein, 280 feet in the middle and 95 feet in the north vein, in all of which the ore holds its own in quantity as well as quality, the average thickness being about 20 feet. The trend of the south vein is nearly east and west, but the others appear to swing around to the northwest at the west end towards No. 3, thus showing that the formation widens out very considerably going west. A large amount of ore remains to be broken on the 320-foot level, while the shaft is down still another level, and a drift through from the bottom a distance of 90 feet to the south lens, and others in progress north and west to catch what is called the shaft stope. While this last or 360-foot level is being prepared for stoping the shaft is on its way down to another, the floor of which will be 400 feet below the surface, it being the intention to keep two or three levels opened up ahead in the future.

In No. 3 there is a body of ore 110 feet wide, which, however, is split lengthwise in the center by a stratum of soapstone 4 feet thick. In this pit the ore of the north half of the vein has been mined out for a distance of 110 feet west of the shaft, on the 280-foot level, and that of the south half over a length of 50 feet in the same direction, with the ore continuing both east and west. Indeed, it is estimated that there is still a body of ore 370 feet long, 40 feet high, and averaging from 20 to 25 feet in width yet remaining unbroken on this one level. The shaft and winzes, in the meantime, have been sunk to the 320-foot level, and at the time of the writer's visit (Feb. 7) drifts necessary to the opening up of new stopes were in active progress. Some idea of the amount of ore that can be mined the present year from this one pit, may be gathered from the extent of ground remaining unbroken on the 280-foot level, as stated above, and the fact that the next level below, yet intact, will very shortly be ready to yield a still larger product.

No. 5, to which no direct reference was made in our last annual report, is in the south foot-wall vein, and is so designated from the old open pit above it. It is located south of No. 2 shaft, and has been wrought the past year by "raising up" from the 180-foot level, or, as the miners term it, "breaking down the back"—i. e., mining the ore out from overhead. In some places the ore has thus been taken out to a height of 120 feet above the 180-foot level, the pit having been made to produce quite largely last year. There is still a large amount of ore remaining in No. 5, a fact that would scarcely be worth mentioning in writing of a mine of such magnificent proportions, were it not that the 180-foot level constitutes its bottom—all below that level is considered a part of No. 2, with which it is connected.

No. 6 is now connected with No. 2 by a drift in the south vein on the 180-foot level. There is not much ore to be seen at this point, but three diamond drill holes, south, south-east and south-west, cut two veins each 5 to 6 feet thick, and rapidly widening out going west.

In No. 7 the ore has been mined out over a length of 530 feet on the 160-foot level, the vein at this depth averaging, by actual measurement, very nearly 25 feet in width for the length stated, thus showing that it is gradually growing larger. This fact strengthens the opinion we expressed last year, that No. 5 would, at the same depth, rival in yield the very large deposits in Nos. 2 and 3. A new skip-road has been dropped to the 5th or 200-foot level, near the center of the lens, measuring lengthwise, at which point the miners are sinking for east and west stopes the whole width of the ore body. The dip of this lens is to the north, indicating that it may possibly have some connection with the large body of ore which is known to underlie the swamp to the north-east of it.

At the hematite pit the ore is being mined out on the 220-foot level, on the plan referred to in our last annual report. The ore has thus all been mined out for a length of 280 feet east of the shaft, the ground being re-filled with waste rock from the surface. The shaft and winze are now both down to the 280-foot level, and drifting is in progress, the plan being to leave above this level a roof 20 feet thick throughout the whole pit, thus making, practically, a new mine of it below the 220-foot

level. The deposit appears to be as large as ever, and no diminution of product is expected in that quarter.

The Lowthian is down to the 220-foot level, where there is a body of ore averaging from 30 to 40 feet wide and 180 feet long, on the foot-wall side. There are in this pit three separate veins—the middle one, as far as opened up, being 30 feet wide; the size of the one on the north is as yet unknown, but will soon be determined by a drift now in progress. The south vein is worked out down to the 220-foot level, on which the others are still being wrought. A new shaft, more in the center of the deposit, is now sinking to the 280-foot level. The Lowthian, which is far removed from the other pits of the Lake Superior, is in itself a mine of goodly proportions, and from which there was mined in 1881 something over 31,000 tons, a product that can be increased the present year—judging from the fact that the mine looks better than at the date of our last annual report, when we predicted a product of at least 20,000 tons for 1881.

A new plant of machinery, consisting of a pair of 24x48 engines, with automatic cut-off, and four drums 12 feet in diameter, and having a capacity for 1,700 feet of wire rope, has just been added to the mine equipment. These engines have steam jackets, with $\frac{3}{8}$ -inch space, through which the live steam passes into a trap and thence back into the boiler, by which means the cylinders are kept entirely free from water. The drums are placed two on each side of a jack-shaft, and so arranged that they can be operated independently of each other. They are by far the largest hoisting drums on Lake Superior, excepting only those in use at the Calumet & Hecla copper mine, which are 25 feet in diameter but not nearly so long. This plant is located in a stone addition to old No. 1 engine house, the dimensions of the addition being 60x70 feet. It rests upon a most elaborate and expensive foundation—20 feet of solid masonry resting on the solid ledge, above which there is 10 feet more of brownstone, with the necessary chambers and passages to afford access to all parts of the plant, underneath as well as above.

The principal pits are lighted by electricity, the electric lamps having been introduced late last fall. The usual number of power drills are employed, the mining force is about the same as last year, and as may readily be inferred the same comprehensive though

economical management continues in the direction of the company's affairs—Mr. C. H. Hall, general agent, and John McEncroe, underground captain. That the writer indulges in no eulogies of this celebrated mine and its excellent management may be ascribed to the fact that the array of figures in the beginning of this paper tells, better than he could relate it, the whole that can truthfully be said.

THE JACKSON MINE

has been wrought almost without interruption since 1846, the section on which it is located having been taken under a permit from the secretary of war soon after the township surveys were made by the government surveyors, but before the townships had been subdivided. Since the commencement the annual production of the Jackson has been as follows:

	<i>Gross Tons.</i>
1856, and previous.....	30,000
1857.....	12,442
1858.....	10,309
1859.....	28,377
1860.....	41,295
1861.....	12,919
1862.....	46,096
1863.....	77,237
1864.....	83,905
1865.....	65,505
1866.....	92,287
1867.....	127,491
1868.....	130,524
1869.....	125,908
1870.....	127,642
1871.....	132,297
1872.....	119,910
1873.....	130,131
1874.....	105,600
1875.....	90,568
1876.....	98,480
1877.....	80,340
1878.....	83,121
1879.....	103,219
1880.....	120,620
1881.....	118,939
Total.....	2,185,162

At the Jackson mine proper, as the old workings may be termed, operations are at present being carried on in only three of the pits—Nos. 5, 6 and 7. No. 5 is, however, a double pit, the two separate chambers being generally referred to as north and south No. 5. They are connected by drifts on the

several levels, but the ore is all taken out through one shaft in the south pit. In North No. 5 they are at present taking out the ore above the timber roof spoken of in our last annual review, though but little remains to be broken. Sinking is in progress to the 5th level, but the lens appears to be narrowing up going east and west from the center, and for that reason is not as promising as it was on the level above.

In South No. 5 a new lens was discovered by drifting south-east through 15 feet of soapstone. This lens is about 12 feet wide, as far as known, a breast stope 30 feet high having been worked out over a length of about 40 feet. It laps the other lens, is cigar shaped, and appears to close in at both top and bottom. Its length is at present unknown, but it appears to be growing wider as the stope progresses eastward. The south wall, in which there are found numerous small lenses of a hundred tons or less, is being taken down, the ore thus obtained adding very considerably to the present yield of the pit.

In No. 6 there are two stopes on the 6th level and three on the 5th—two of the latter going east in separate benches, and the other west. The top stope going east on the 5th level is now under the bottom of No. 5 pit, and the lower one is following in the same direction. On the 6th level the ore has been stoped back 50 feet each way from the shaft, there being 25 feet of ore in the west stope; while going east, as shown by the stopes on the level above, it gradually narrows down to 8 feet in a length of 150 feet, suddenly widens out to 16 feet, and then again narrows down to 8 feet 60 feet further along. The shaft crossed the vein on the 6th level, but a drift 12 feet south was made, from the end of which the ore was struck in sinking 8 feet. After sinking 12 feet into this ore the miners drifted 40 feet east and the same distance west without encountering rock of any kind. This discovery was wholly unexpected, the lens being to all appearances an isolated one. It looks as if it might prove a most valuable auxiliary to this part of the mine, the ore being of the very best quality. No. 6 shaft is now going down to the 7th level, the ore body in this pit appearing to hold its own, both in quantity and quality.

In No. 7 another level of 60 feet has been reached. On this lower level a drift south passed through 70 feet of ore before striking the jasper. This ore, the existence of which was unknown at the time the shaft was started on the last lift, was

accidentally found 40 feet above the drift referred to. When the shaft had been sunk 20 feet below the old level it was found necessary to cut a notch in the supposed hanging-wall to make room for a pump, where, to the surprise of the miners as well as of the management, the ore was struck in a very few feet. After drifting into the deposit 40 feet across the formation the shaft was dropped to the 150-foot level, where the ore body, as stated, is found to be 70 feet in width. This discovery is important in that No. 7 was considered pretty well exhausted, whereas, it now looks more promising than at any time in the past. The shaft is supplied with a new skip-road put down on an angle of 66 degrees from the perpendicular, and all the mine work in this quarter is now confined to opening up the newly discovered deposit, save that a few men are engaged in taking down some bunches of good ore in the east end of the old pit.

The north mine was surrendered to the Iron Cliffs company last fall, in lieu of the Pioneer opening of which that company held a lease, and in which they claim to have exhausted the ore. It does not appear, however, that the lessees made any effort to find new lenses at the Pioneer—a work which will be undertaken by the Jackson now that the Iron Cliffs lease has expired. The drift from No. 6 to the north mine, of which mention was made in our last report, is now 600 feet on its way, and is expected to strike the north deposit 100 feet under the present working level. In its progress two pieces of promising ground were struck, apparently the east and west ends of separate lenses, which will be properly looked after when the drift is completed and such connection made as will give the necessary ventilation.

All the pits at the South Jackson are being wrought, and there is no perceptible change in their condition, except that they are necessarily some deeper. The miners are simply following wherever the ore leads them.

The Jackson is working about the usual force of men, and the product the present year will about approximate that of 1881. Capt. Merry still remains in charge, and it would seem as if nothing but death or extreme old age could ever sever the relations he has so long held to the company.

THE BARNUM MINE,

which, together with the Salisbury, Foster and Section 12 mines, are the property of the Iron Cliffs company, did full as well last year as could reasonably have been expected, and better than was predicted in our last annual report. During the past fourteen years the annual product of the Barnum has been as follows:

	<i>Gross Tons.</i>
1868.....	14,380
1869.....	33,484
1870.....	44,798
1871.....	45,939
1872.....	38,381
1873.....	48,076
1874.....	41,403
1875.....	43,209
1876.....	37,632
1877.....	37,509
1878.....	26,680
1879.....	24,015
1880.....	24,522
1881.....	27,883
Total.....	487,906

As will be remembered, the dip of the Barnum ore deposit carries it across the Lake Superior line, and at the date of our last report No. 1, the most easterly pit, had been worked out down to the line and abandoned. This year's work will likewise exhaust all the ore on the Barnum side of the line in the east half of No. 2, from which a 47-foot stope has been mined out during the past twelve months. It is calculated that there is still two years work in the west half of the pit, from the whole of which a product of about 1,000 tons a month is being raised, a yield that will probably be realized throughout the present year, or until the east end of the pit is exhausted.

No. 3 looks well, and shows no material change except that it is 42 feet deeper. There is, on the west side of the skip-road, a run of ore 12 to 15 feet thick and at least 100 feet long, and on the east side of it from 5 to 7 feet, extending over a length of 75 feet. It will take several years to exhaust this part of the mine, if, indeed, the pitch of the vein to the west does not effect a material improvement on the lower levels. Nos. 2 and 3 constitute all there is of the "old mine," and an enlarged product the present year would be out of the question—though these two pits are considered good for 27,000 tons—were it not

for the completion of A shaft at the so-called "new Barnum," which is now down to the ore, and from which the local management promises at least 20,000 tons the present year. This shaft, which was fully described in our last annual review, struck the ore at a depth of 424 feet from the collar; its total depth is 485 feet, including the sump, which is 15 feet wide, 30 feet long, and 15 feet deep. The shaft passes through 46 feet of ore, the vein or deposit dipping 45 degrees to the south. This would give 32 feet of ore at right angles to the dip. To open up this deposit two main drifts or galleries 12 feet wide and 16 feet high are being driven east and west from the shaft, and will be continued indefinitely, or as long as ore is found. Fifty feet from the collar, on each side, cross-drifts will be driven north and south, leaving a block of solid ground 100 feet square around the shaft. Other cross-drifts from the main gallery will be made so as to prepare as many large stopes as may be deemed advisable, leaving of course, as many pillars of solid ore as may be necessary to support the roof. In this way a large extent of ground can be kept open ahead of the miners, and there need be no limit to production within the capacity of the single cage on which the ore is to be raised to the surface. The shaft, it is true, is large enough for a double cage lift, but for some unaccountable reason the large and expensive machinery was ordered and designed for the operation of a single cage only—or rather for two cages in separate shafts. The cage has not yet been put in, and will not be until the main gallery has been driven far enough back from the shaft to render it safe to do so—possibly not till the first cross-drifts are made, and work commenced on the stopes.

B shaft, which was referred to last year as being something new and novel, has been temporarily abandoned. An effort was made to sink an iron caisson, $10\frac{1}{2}$ feet in diameter, through the quicksand to the ledge, and well nigh succeeded. When, however, it had been forced down to within 7 feet of the ledge, the immense pressure crushed the bottom sections into an oval shape, and out of line, and it had to be abandoned. It is now the purpose to put in a timber shaft around the iron caisson, which will then be taken out. Work on this timber shaft will be commenced very shortly; and here captain Sedgwick proposes to prove that a Worthington pump, at least, can be made to work under 40 feet of water, as he intends to unwater

the shaft with such a pump, which is now, and has been for several months, at the bottom.

The large and very substantial engine house referred to in our last report has been completed, and in it has been placed the machinery which had then been ordered, and which consists of two 28x36 condensing engines—one of which will operate two 14-inch plunger pumps, and the other two 8-foot V friction drums, all of Hodge's make. During the winter a 2-inch pipe was laid from the new engine house to the "old Barnum," a distance of 1,800 feet, by drifting under the frozen ground, except in the swamp where an open trench had to be cut. By this means the boilers at the old Barnum are supplied with water, that in the pits having become unfit for use.

This mine now gives employment to about 150 men, and may be safely counted on for a product of from 45,000 to 50,000 tons this year. Capt William Sedgwick is still in command, and is likely to retain it as long as he will consent to remain, such is his recognized ability as a practical miner and careful manager.

THE SALISBURY

Has thus far been the most productive of any distinctively soft hematite mine in the Marquette range. It is true there are others that have achieved a large aggregate product, but they have likewise been wrought a greater number of years, and if we figure the annual average the Salisbury is ahead. Since the mine was opened in 1872 her yield has been as follows:

	<i>Gross Tons.</i>
1872.....	545
1873.....	11,023
1874.....	6,730
1875.....	4,571
1876.....	20,510
1877.....	37,869
1878.....	52,155
1879.....	39,293
1880.....	21,457
1881.....	43,690
Total.....	237,843

Taking a surface view a person can see no change in the Salisbury workings; the old bottom of No. 1 pit shows about the same depth and is still intact, all the ore raised from the open level the past year having been taken down from the sides

of the pit. There is still a large body of ore standing on the south, or hanging-wall side, which, however, cannot be taken out until a large amount of rock facing it is removed. The drift from the perpendicular shaft at the south-east end of this pit has been extended all the way under the three pits to the extreme western limit of the deposit in No. 3, leaving 70 feet of ore overhead. From this drift the deposit in No. 1 is now being mined out in rooms or chambers, on the California or Nevada plan, all the ore at present being raised coming from this level, though very little mining has been done from the drift under No. 2, and none at all in No. 3. In No. 2 the ore body is about 40 feet wide on this lower level, but in Nos. 2 and 3 the width has not yet been proved.

An important discovery was recently made, in that it promises to add largely to the productive capacity of the mine. A drift 50 feet south from the bottom of the shaft, through the diorite, passed through 40 feet of very fine hematite into lean ore and quartzite. It is by no means certain, however, that this drift cut the ore at right angles, but captain Bartle, the superintendent, claims that allowing for the greatest possible variation in the strike, the deposit is at least from 20 to 25 feet in width. It is the intention to commence work in this deposit at once, and the writer will be mistaken in his guess if it does not develop into a pit of goodly dimensions.

What is called the east pit, has been opened since our last annual review. It is located in the range of hills opposite that in which the old workings are situated, and about a quarter of a mile east of the engine house. The funny thing about it is, that the ore, which is superior in quality to that of either of the old pits—too good, in fact, to be classed with the so-called hematites of the district, though not strictly a red specular—was found just where the geologists said it could not possibly exist, and where one of them ventured the suggestion no one but a fool would look for it. The local superintendent had run a drift into this hill 110 feet, when, on the strength of the scientific opinions referred to, the drift was stopped, as now appears, within a very few feet of the ore, or at all events a few feet short of a point in perpendicular line with the deposit 100 feet above. Not satisfied that he was wrong the superintendent concluded to venture a few surface explorations, the result of which was the discovery of a deposit from which nearly 5,000 tons were

mined last year, and in which there is now a stope 25 feet high and 18 feet wide. The trend of this deposit is east and west, the foot-wall being a jasper, lined with about 6 feet of paint rock, and the hanging a quartzite.

At the old workings a new skip-road has been placed in the east of No. 1, but no new machinery has been added during the year. About the same number of men are employed; Capt. Bartle remains in charge, and promises a product of at least 45,000 tons the present year—if he does not see his own “blind,” as the boys say, and go it 10,000 better, it will be because of some unforeseen accident, and for no other reason.

THE SECTION 12 MINE

Shows no material change, except that at the west end the ore has been worked out down to the Jackson line. The workings are in the north-east corner of the section, and the trend of the formation is from north-west to south-east—from the Jackson on the north to the McComber on the east. The dip is to the north, and consequently the length of the deposit is gradually being shortened, though there is yet a body of ore from 10 to 15 wide and 100 feet long, in the bottom. There is, however, a large block of ground between the present workings and the McComber line, which has not been explored. It is the intention to explore this ground by a drift from the open pit eastward towards the most westerly shaft of the McComber, in which ore was struck at about the same depth. A large fall of rock last spring very seriously retarded mining operations, and it is not expected that over 5,000 tons will be mined the present year. The output of this mine has been as follows:

	Gross	Tons.
1879.....	5,027	
1880.....	330	
1881.....	13,243	
Total.....	18,600	

THE FOSTER MINE,

Which has been practically idle since 1873, is about to resume her place among our active mines. This mine was opened in 1865, since which time her product has been as follows:

	<i>Gross Tons.</i>
1865-8.....	6,000
1869.....	14,540
1870.....	23,458
1871.....	13,532
1872.....	18,684
1873.....	18,107
1874.....	4,719
1875.....	847
1876.....	125
1879.....	4,804
1880.....	1,122
1881.....	3,011

Total..... 108,949

Work was resumed last December with the intention of mining and shipping 10,000 tons the present year. As stated in our last annual review, the ore varies in quality, and occurs in lenses or pockets, the several open pits aggregating about 500 feet in length, worked out to depths ranging from 50 to 100 feet. There are no new developments, present operations being confined to the old pits.

Recent explorations made by the Iron Cliffs company, in the swamp just north of the Chicago & Northwestern passenger depot at Ishpeming, have resulted most satisfactorily, having demonstrated to a reasonable certainty that the swamp is underlaid with a large deposit of hematite ore of good merchantable quality. Some three or four pits and shafts are all down in ore, but as yet no attempt at mining has been made. The ground is very wet, and the intention is to test it as thoroughly as possible before incurring the very considerable expense without which a mine cannot be successfully opened and worked.

THE TEAL LAKE RANGE,

so-called, lies along the south shore of the lake of that name, and in it are embraced the Cambria, Bessemer, and what was until lately known as the Cleveland Hematite, mines, together with other properties now in progress of development.

THE CAMBRIA

is the most easterly of the three named, and one which, though opened in 1874, is but just entering upon, it may be said, the first stages of practical development, having in 1881 very nearly doubled the product of any preceding year. The annual product of the Cambria has been as follows;

	Gross Tons.
1874.....	2,610
1876.....	6,320
1877.....	10,068
1878.....	3,754
1879.....	6,724
1880.....	6,958
1881.....	19,245
Total.....	55,708

There are five pits at the Cambria, but mining operations are now confined exclusively to Nos. 1 and 5, from which the great bulk of the 1881 product was mined. No. 1 is the most easterly pit, and is now worked on the underground plan, the ore being raised through an incline shaft, the angle of which is 45 degrees to the east. The vein, which is about 16 feet wide, was found to pitch rapidly to the east, and the shaft referred to was put down on an eastern incline so as to keep it as nearly as possible at all times near the center of the pit, which, of course, is lengthening out on each succeeding level. This shaft is now down 200 feet, and sinking to another level is in progress. On the present level there is a stope 15 feet high behind which there is a vein of ore 100 feet in length, west of the shaft, and it is expected that in sinking another lift a stope equally as large will be obtained to the eastward. At present no more ore is taken out of this pit than is absolutely necessary in sinking and preparing for the coming summer's work, which may likewise be said of No. 5 where, however, there is at this writing (Feb. 15) a stock-pile containing at least 8,000 tons of ore, all of which has been mined since the close of navigation last fall, notwithstanding operations have been principally confined to taking down rock and preparing the pit for an active mining campaign the coming summer. This working is a large open pit, nearly, if not quite, 100 feet square, the bottom of which appears to be nearly all in ore of good quality, while a drift sixty feet south shows good ore all the way, with some patches of poor ground. The ore body apparently swings round in a southerly curve to a connection with No. 3, which is 150 feet due east. There is here, most certainly, a very large deposit of blue and brown hematite, from which it would seem to us the local management should, without extra effort, be able to raise the product promised from the whole mine the present year—20,000 tons. Unfortunately for the company, however, the

whole west side of the pit, presenting a solid face of ore, marks the dividing line between the Cambria and Bessemer, and farther they cannot go in that direction. As in No. 1, however, the ore pitches rapidly to the east, and the writer ventures the opinion that, large as the deposit appears on the present level, it will be found to gradually gain in length in sinking to succeeding levels.

No new machinery has been added during the year. A force of about 60 men is employed, with Gordon Murray, an experienced miner, in charge.

THE BESSEMER MINE,

Which lies immediately west of the Cambria, has mined and shipped, since 1876, as follows

	<i>Gross Tons.</i>
1876.....	6,945
1877.....	10,127
1878.....	8,506
1879.....	22,380
1880.....	18,347
1881.....	16,718
Total.....	88,023

As suggested in our last annual report might be the case, the old open workings of the Bessemer have been practically abandoned, owing to the dangerous character of the walls. It must not be surmised, however, that the ore in either of them has been exhausted; it is simply impracticable to mine the ore out to any greater depth, in open pits, and it has therefore been determined to sink a shaft in No. 2, and thus attack the deposit throughout its whole length by drifts under 1 and 3, thus making an underground mine of it. There is undoubtedly a large amount of ore in these three pits which can thus be secured, and which is not to be obtained in any other way. In fact it will simply be the commencement of real mining operations, and an enlarged annual product may be looked for from this part of the mine as soon as this underground plan of operations shall have been fairly inaugurated.

At the east pit, on the Cambria line, the large deposit partially uncovered last year is being further stripped, and every preparation is being made to open it up on an extensive scale. This deposit is at least eighty feet wide, and has been traced in test pits nearly, if not quite, 200 feet towards No. 1. Looking from the Cambria pit No. 5, there is a slope of the width named

above at least thirty feet high, and we can see no reason why this one pit should not afford a product this year equal to the whole output of the mine in 1881. The ore is principally a fine blue hematite, more nearly resembling the best Bessemer ores of the Menominee range than any other yet found in this district. Indeed, there are few comparatively new mines in this region that present a more promising outlook than the Bessemer.

Two new boilers have been added to the plant. The management has not favored us with an estimate of product for this year, but we venture the assertion that it will be no fault of the mine if a very considerable increase is not shown at the close of the season. Dan McLaren is still in charge as mining captain.

THE FOREST CITY

mine, which started with some prospect of a successful career, about a year ago, was shut down after 1,895 tons had been mined from an open pit. It is generally believed that this amount of ore exhausted all there was of the deposit on the company's leasehold, which embraces only ten acres off the west side of the 40-acre tract lying immediately west of the Bessemer, if we except 40 acres lying further north, and on which no ore is ever likely to be found, and a 40-acre tract on the Negaunee range. It was not to be expected that a very large amount of ore, which must necessarily dip in some direction, would be found on or in a piece of land only 20 rods wide and 80 rods long—the length being across the formation. It was a stupidly conceived enterprise and one that is not likely to be revived, for the simple reason that the lessees have nothing upon which to base even a faint hope for the development of a paying mine on the elongated ten acres which constitute all there is of any possible value in its Teal Lake leasehold.

The thirty acres lying between the Bessemer and Forest City is under lease to D. F. Wadsworth, Esq., of Ishpeming, who is now engaged in sinking a shaft into a deposit of clean ore, lately found at a depth of 77 feet from the surface by boring with an Ohio coal drill. The drill penetrated 28 feet into ore of very fine quality, but of course the extent of the deposit cannot be definitely ascertained except by sinking and drifting in the regular way. It would be an exception to the rule on this range, barring the Forest City failure, if Mr. Wadsworth's dis-

covery should not ultimately result in the development of a paying mine.

Immediately west of the Forest City is the mine lately known as the Cleveland Hematite, but which is now a part and parcel of the Cleveland mine, in connection with which it has already been referred to.

Adjoining the last named is the Norwich, which promises to become one of the most valuable hematite mines in the district. A shaft is down some 25 feet, from the bottom of which a drift has been run north over 50 feet, all the way in clean ore, full as good as any yet found in the Teal Lake range. A test pit about 100 feet east shows ore of the same quality, while a second shaft, about 100 feet west of the one first spoken of is likewise in clean ore, which undoubtedly lies in a large body. The property consists of 40 acres, and is owned in fee by the Norwich Iron Co.

East of the Cambria an exploring force is at work for Andrews, Hitchcock & Co., of Youngstown, Ohio, with a very fair prospect of developing something of value.

THE NEW YORK MINE

is a fair example of the value of a well located 40-acre tract of land in the Lake Superior iron region. The work of development was commenced in 1864, since which time the annual production of the mine has been as follows:

	<i>Gross Tons.</i>
1864.....	8,000
1865.....	12,214
1866.....	33,761
1867.....	43,802
1868.....	45,665
1869.....	71,456
1870.....	94,809
1871.....	76,881
1872.....	68,950
1873.....	70,882
1874.....	77,017
1875.....	70,103
1876.....	58,863
1877.....	55,581
1878.....	21,903
1879.....	57,528
1880.....	58,000
1881.....	50,489
Total.....	974,489

On which product it has paid to the lessor, in royalties, nearly, if not quite, a quarter of a million of dollars, while the gross earnings of the lessee may safely be estimated at not less than five millions. Ex-governor Tilden, of New York, is the principal owner of the leasehold, but the foregoing estimate of earnings is not made with a view of influencing the public mind as to the merits or demerits of the government's claim against that distinguished gentleman for unpaid income tax, because the law imposing such tax was repealed before the New York mine had earned half the amount above stated, and up to that time it is possible the ex-governor may have been a loser in other enterprises to an amount sufficient to offset his gains hereaways. The matter is referred to solely for the purpose of showing the profitableness of well considered investments in Lake Superior iron properties, and with no intention of "giving away" the private business affairs of any individual or corporation. As we remarked last year, the New York is the "largest mine of its size" in the district.

Operations are now wholly confined to Nos. 2, 3, 4 and 5—the No. 2 of the present being what was last year known as No. 1. No. 2 is down 530 feet on the dip of the formation, at which depth the ore body carries an average thickness of 30 feet. On this level there is a run of ore 200 feet long, which is being mined out in 30-foot stopes, most of the ground remaining unbroken. It is in this pit that the ore body swings around to the north, and it is proper to say that the ore east of the bend is gradually being worked out down to the Cleveland line, so that ere long the part having a north and south trend will constitute the whole of this end of the mine. Around the curve to the north, however, the dip is to the west, and there is no such difficulty, since it will be many years before the deposit can be mined out down to the company's line in that direction. The pitch, too, seems to be to the north, and each succeeding level shows an extension of the ore body.

No. 3 is down 385 feet, on the dip of the formation, in a body of ore 16 feet thick, and, so far as known, 130 feet long. There are on this 385-foot level two stopes—one on each side of the skip road—each 35 feet high, most of the ground represented by the length and thickness of the lens, to the height stated, remaining to be broken. The skip road strikes the lens near the center, so that the greatest convenience is attained in

tramming and hoisting the ore after it is broken. There is a full summer's work remaining on this level.

No. 4, which is in an entirely different lens, the trend of which is nearly east and west, is down 277 feet, with a run of ore 12 feet thick and about 75 feet long, west of the skip-road; in the east end the rock is coming in and rapidly displacing the ore. The stopes in this pit are 35 feet high, and the ore perfectly clean. Most of the ore on the bottom level is still standing, the stopes having just been commenced.

No. 5, which has heretofore been more or less "bunchy," has very materially improved on the 315-foot level. The bunches of rock are of less frequent occurrence, the formation is much more regular and settled, and it is believed that when another level of 50 feet, to which they are now sinking for stopes, is reached, the ore body will be found entirely free of rock of any kind. The lens is about 10 feet thick, and should it improve as expected, can be made to add very materially to the aggregate production of the mine.

No. 6, which is north of the C. & N. W. B'y, has been wholly abandoned, there not being sufficient first-class ore to pay for mining, and it not being the policy of the management to handle any more second-class than is absolutely necessary in mining that of a better quality. A few scrammers are at work in the old Beardsley pit, but that, too, is practically exhausted, and is being filled up with waste rock from the other workings.

Nothing new in the way of machinery has been added the past year, if we except a new 8-inch Cornish plunger in No. 1 pump shaft, which is located midway between Nos. 2 and 3 skip-roads. Another pump of the same size will be placed in a new shaft now being sunk, 230 feet deep, from a point near the bottom of No. 1, and through which the water will be raised into the sump of No. 1, and thence to the surface. Eleven power drills—5 Rand, 3 Burleigh, 2 Ingersoll and 1 National—do the drilling, but the management gives the Rand the preference, and has determined to discard all the others.

The mining force numbers about 200 men, all told, and shipments for the season began from a winter's accumulation of about 23,000 tons—a larger winter's work than has been accomplished at this mine for some years. Lawrence McCloskey, Esq., is the general manager and superintendent, and is ably seconded by Aug. Beerling, an experienced miner, as mining

captain. Captain Beerling was for some years assistant to Capt. Dickinson, whom he succeeded, so far as the mine work is concerned, when that gentleman resigned. John C. Cutter, a very pleasant gentleman, manipulates the company's accounts, and disburses the cash to its employes with the most commendable regularity.

We can see no reason why the New York should not materially increase her product, as compared with last year. The pits are all in admirable condition for rapid and economical work, and the stopes which have been prepared during the winter ought to supply ore enough to run the product up to at least 60,000 tons. The management is a most careful, economical, and, at the same time, energetic one, and a renewal of the lease having been secured, there is every prospect of the past gratifying record of the New York as a most lucrative mining property being repeated in the dozen years to come. Indeed, it is fair to believe that the possession of such a magnificent property was the one principal thing that enabled Mr. Tilden to bear the loss of the presidency, after receiving a majority of the popular vote, with such heroic complacency.

THE REPUBLIC MINE,

since the beginning of mining operations, has produced as follows:

	<i>Gross Tons.</i>
1872.....	11,025
1873.....	105,453
1874.....	122,639
1875.....	119,726
1876.....	120,095
1877.....	165,839
1878.....	176,221
1879.....	135,231
1880.....	235,387
1881.....	233,786
Total.....	1,425,399

This is an average of 142,539 tons a year, since the beginning, and very nearly 200,000 during the last five years—while the mine is in condition not only to maintain her present annual product, but, if necessary, to very materially increase it.

Taking the pits in the same order as last year, we will commence with the Perkins, which is the most south-western of the group. This pit was abandoned last year, the ore having been

exhausted in the bottom. A diamond drill hole, however, through 12 feet of jasper, on the hanging-wall side, shows $10\frac{1}{2}$ feet of clean red ore, into which a shaft is now being sunk, on an angle of about 58 degrees from a point about 35 feet above the bottom level of the old pit. If the developments warrant it, a skip-road will be put in; the hoisting is at present being done with what captain Pascoe calls a "puffer"—one of Merritt's portable engines.

At the Morgan one "lift" of 60 feet has been added to the depth, and another is going down to the 6th, or 360-foot level. The ore body holds the same width as on the upper levels—about 50 feet, though an occasional bunch of jasper is encountered by the miners. A new plunger at the bottom of the present working level does the pumping from a cistern into which smaller pumps raise the water from the lower levels. This pit is about 225 feet in length.

The Pascoe pit is down to the 3rd or 180-foot level, 30 feet of ore having been left immediately below the bottom of the old open pit as a roof to the underground workings. It is supplied with two double skip-roads, which are necessary to hoist the ore from this, which is one of the best pits in the mine, the average width of the ore body being at least 50 feet, with no mixture of rock. In addition to this there are several spurs of ore that branch off from the main deposit into the foot-wall, and on which a force of scrammers are constantly employed.

In the Ely pit a very marked change for the better is observable. The ore has cut out the jasper referred to in our last report, and the present bottom, which is all ore, has gained at least 70 feet in length, and somewhat in width. This speaks well for the future of the mine, indicating as it does that the ore body may, at no very considerable greater depth, be found continuous through the whole chain of pits, which cover a length of nearly, if not quite, a mile. In the Ely they are now sinking for stopes, taking out 25 feet of ore the whole width of the deposit.

At the Gibson there is no change, except that the pit is 30 feet deeper.

No. 1 has been carried down another level during the past year, and connected with No. 2, the lower levels of the two corresponding in depth. The pit improves with each succeeding level, which is equally true of No. 2. There is here a continu-

ous run of ore 360 feet in length, of the width of, perhaps, 15 feet, the lowest level being about 300 feet below the surface. A new 12-inch plunger pump is now being placed on the level next above the present bottom.

In No. 3 the roof recently became unsafe on account of the rapid widening out of the ore body, and the occurrence of a horse of soapstone together with a large vugg. This and No. 4 are now really one very large pit, to secure the safety of which arches will be turned across the deposit below the 5th level, instead of lengthwise, as in the beginning. There is here a very large body of magnetic ore, vastly more than could have been expected from the size of the deposit on the upper levels, there being at the least calculation a whole year's work for a large force of miners on the 5th level. This magnetic ore now extends clear along the hanging-wall of 3, 4 and 5 to a point beyond No. 5 shaft.

Nos. 5 and 6 are being wrought on the same plan as last year, the ore being about the same in quantity and quality. These, together with Nos. 3 and 4, (the numbers having more special reference to the shafts and skip-roads) constitute, perhaps, the largest hard ore pits to be found in this or any other mining district—the dimensions having been given in our pamphlet review for 1880, need not be repeated here. Since then, however, they have been carried down one more level to the 7th, and the shafts and winzes are on their way to the 8th, the floor of which will be 428 feet below the surface.

No. 6½ is still further along to the north, is 20 feet wide and 50 feet long, with a 30-foot pillar dividing it from No. 6. Two-thirds of the deposit is magnetic and the balance slate, the product being taken out through No. 5 on the 6th level. It is in this pit that the horse of jasper, which appeared on the top to extend through and divide the deposit as far as No. 7, occurs; but the ore now appears to be rapidly cutting under, and bids fair to wholly displace the jasper, which last, however, is so secured that its removal will not be necessary. Thus it will be seen that what formerly appeared to be two separate and distinct lenses very probably come together at no very considerable depth below the present working level. Indeed, this appears to be the case wherever horses or rock-crossings occur in the mine, thus demonstrating to an almost absolute certainty that an unbroken basin of ore will be found in sinking a few more

levels, and giving assurance of a very large annual product for many years to come.

No. 7 presents nothing new, and no improvement is noticeable. The ore lies in isolated deposits, but the shaft is now being straightened out, and the superintendent confidently expects, in one more lift, to cut the ore coming from 6½. No. 8, which is in, fact, a continuation of No. 7, is 220 feet long, and about 11 feet wide, with stopes 45 feet in height, under 18 feet of ore which has been left for a roof, thus making it, together with No. 7, an underground pit of goodly proportions. A new shaft and skip-road has been put in, through and upon which the product is hoisted to the tunnel level.

No. 9 is an isolated deposit, which, not proving profitable, has been abandoned. It is more than probable, however, that it will ultimately be found to have a connection with the No. 8 lens, the strike of which is carrying it rapidly in that direction.

No. 9½ shows no change from last year, except that it is 50 feet deeper, the lens being about 10 feet wide and 50 feet long. No. 10 has been abandoned, the ore, which was about 6 feet wide, having almost entirely given place to jasper.

No. 11 is looking about the same as last year, except that 30 feet of the floor has been taken up. This is the letter P shaped lens, the stem of which is about 6 feet wide and 40 feet long, and the bowl about 15 feet square.

The Kingston pit, which is on the west side of the river and adjoining the Columbia, looks at least 50 per cent. better than at this time last year. The pit is about 75 feet long, 12 feet wide and 150 feet deep, the length and width representing the size of the lens, so far as developed. The diamond drill is now boring on the supposed course of the ore belt, at a point about 300 feet from the railroad bridge, east of the river, with good indications. The whole of this part of the Republic tract will thus be thoroughly explored, as will also the lands owned by the company a short distance east of the Boston and Sterling mines. The Kingston pit has been supplied with a new plant of machinery, consisting of a pair of 12x22 twin engines, with link motion, and two 5-foot internal friction clutch drums, of D. H. Merritt's latest patent. The same engines are also driving a new pump gear. The drums are both mounted on one shaft, but so arranged as to operate independently of each other without stop-

ping the engine. The plant, which is complete in every particular, was built at the Iron Bay Foundry, Marquette. Altogether the Republic is in the best possible condition for rapid and economical production, though it is not expected that the product of the present year will be very materially increased over that of 1881. About the same number of men are employed, and captain Peter Pascoe, under whose supervision the mine was originally opened, still continues in charge—occupying a position he will undoubtedly hold during life, or as long as he will consent to remain.

THE CHAMPION MINE

Now ranks third among the great iron mines of the upper peninsula, only two others having achieved a larger product in 1881—though she stood sixth in the list the year previous, and is likely to fall back to the fourth place the present season. It is hardly to be expected that the handsome increase of last year can be proportionately maintained, though a product of not less than 150,000 tons the present year may confidently be looked for by the fortunate shareholders. Since 1867, in which year the Champion deposit was first discovered, the annual product of the mine has been as follows:

	<i>Gross Tons.</i>
1868.....	6,255
1869.....	21,535
1870.....	73,161
1871.....	67,588
1872.....	68,408
1873.....	72,782
1874.....	47,097
1875.....	56,877
1876.....	66,002
1877.....	70,883
1878.....	73,464
1879.....	94,027
1880.....	112,401
1881.....	145,427
Total.....	975,907

The principal workings at the Champion, and, indeed, the ones from which the entire product (except the small portion contributed by the Northampton pit, already described in connection with the mines of the north range,) was raised last year, are what are known as the north and south deposits, and which cover a length of between 700 and 800 feet on the trend

of the formation. The general formation is unusually regular, the ore belt lying between the quartzite on the north and a metamorphic diorite on the south. These walls are from three to four hundred feet apart, the ore-bearing rocks between them consisting of chloritic and talcose schists and masses of banded ore and silica, the whole forming a highly inclined strata of uniform dip and strike. The ore occurs among these rocks in segregations, having the form of flattened lenses. Until a few years ago mine work was wholly confined to the deposits directly underlying and contiguous to the overhanging quartzite; at least such was the case until the discovery of two new lenses by the driving of a drift through what then appeared to be the foot-wall on the south level, from a point about 100 feet east of No. 2 shaft. These two last mentioned lenses are known as the "South-east" and "Old Man's" deposits—though they come together and are practically one deposit on the fifth or 300-foot level.

The shafts at the Champion are seven in number—1, 2, 3, 4, 5, 7, and "A" shaft, the latter being the most easterly. Nos. 1, 2 and 3 are in the north deposit, and Nos. 4 and 5 in the south, while No. 7 and "A" shafts, which are located at the extreme east and west ends of the workings, appear to be in distinct and separate lenses. Both these last have been, to all appearances, exhausted. Neither are at present being wrought, though not less than 10,000 tons were mined from No. 7 before it was abandoned. In this last mentioned pit the shaft was sunk to a depth of 150 feet, the width of the ore at the first level being 16 feet; but at a distance of 65 feet west from the shaft a diagonal crossing of rock was encountered, beyond which the diamond drill failed to discover anything of value. East of the shaft on the same level the ore narrowed down to a width of only four feet, and on the next level below the deposit pinched out altogether. No. 7 is about 800 feet west of No. 5 shaft, and between the two there is a run of ore about 30 inches wide on the surface, the intervening ground never having been explored to any considerable depth. "A" shaft is about 450 feet east of No. 1, and so far as its history is concerned is a repetition of No. 7, and it is therefore hardly necessary to take it into account in describing the mine proper, though further explorations may eventually give it more prominence than is now anticipated.

The ore in No. 1 was exhausted at a depth of a little more than 100 feet, and at the time of our last annual review had apparently been abandoned. Subsequently a small lens was found and worked out, and the shaft is again idle. This part of the ore belt appears to be characterized by small lenses, but the diamond drill now at work may eventually reveal others of greater magnitude in the near vicinity. No. 2 shaft, which, it will be remembered, was down to the 5th level at the date of our last annual review, with the ore all worked out above that level east to the heading of rock which comes in from that direction, is now going down vertically through the foot-wall of the north into the south deposit, an eastern extension of which last has been found by boring with a diamond drill from the east end of the north deposit, on the 7th level. It will be remembered that short cross-cuts from the north deposit, 110 feet east of No. 2 shaft, on the 3d, 4th and 5th levels, tapped what is known as the "South-east" and "Old Man's" deposits, and the "Chimney;" the chimney is now connected with the main south deposit, so that only one drift and winze is now required to open up the south deposit, the product of which all finds egress through No. 3 shaft, which is in the north deposit.

No. 3 is down to the ninth or 540-foot level, where stoping is in progress between the 8th and 9th levels west of the shaft, though there is a large amount of good ore still standing above the 7th and 8th levels, to the west, and above the 8th on the east. The average width of the ore body in the north deposit is at least 45 feet. In the south deposit the miners are now stoping away the ore between the 7th and 8th levels, and at the same time sinking a winze to connect with the drift from the north deposit on the 9th. In this south deposit the lens is from 22 to 37 feet thick, and, so far as known, 320 feet long, on the present working level, it having just about doubled its size in sinking two levels of 60 feet each. In the west end of this south deposit a horse or crossing of jasper came in and was supposed to limit the workings in that direction, but this was found to be only 3 feet thick, and beyond it a body of very fine black granular ore, that east of the crossing being a specular slate. A stope is now being driven west in this newly discovered deposit, which is making towards the boring 120 feet west of No. 3 shaft, where the drill, working from the 4th level where the ore had all been worked out down to the rock cross-

ing, after passing through 158 feet of barren ground, cut 43 feet of clean magnetic ore, measuring at right angles with the dip. This is undoubtedly a part of the lens now being worked from No. 3 west of the jasper crossing, and the pitch being to the west, while the ore body is gradually widening out in sinking, a very material enlargement of the mine may confidently be expected in the near future, though it is large enough now to satisfy anyone, however avaricious, even though he be a stockholder thereof. This extension of the south lens westward will certainly add largely to the value of the mine; and yet it is not the only discovery of importance recently made. In boring south-east from the east end of the north deposit, on the 7th level, the drill cut two lenses lying directly east of the south deposit, one of which is 15 and the other 22 feet thick; they are probably a continuation of, or in some way connected with, the south deposit. They will be more accurately located by boring from the bottom of No. 2, from which point it is believed they can be most easily reached and advantageously wrought. With these extensions of the south deposit east and west the probability is that this part of the Champion will have become at the end of another year the largest single mine, in proportion to the extent of ground covered by the workings, in the whole Marquette district. There is every prospect of there being opened up within that period a body of ore, as represented by the south deposit, extending all the way from No. 2 to some distance west of No. 5, varying from 22 to 45 feet in thickness, while the north and "old south" deposits may be expected to increase in proportion, the former, particularly, showing greater length on each succeeding level, owing to the westerly pitch of the ore. It is really a most magnificent mine, with possibilities for the future far more promising than even its past achievements would seem to indicate to those having no other data upon which to found an opinion. If, indeed, the product of last year shall not be improved upon, it will be simply because the large amount of new and rich ground revealed by the diamond drill cannot be opened up in time to contribute much, if any, ore to the output of the present season. The writer thinks he can see through the clear light of the near future an annual product for the Champion of which 200,000 tons will be the minimum.

No. 4 skip-road, which was originally in the "old south" de-

posit—at one time the principal part of the mine—has been carried over into the north deposit, on the 7th level. This old south deposit, as shown by the workings, is now about 150 feet long and 24 feet thick. The westerly pitch of the north deposit is gradually bringing it nearer to a connection with the “old south,” with which it is now connected by a drift at the west end, through which the ore of the latter is trammed to the bottom of the skip-road. There is a good stope of ore remaining on the 7th level of the “old south,” with no signs of exhaustion apparent in the bottom or elsewhere.

No. 5 is down to the 6th level, where the miners are carrying a stope west, and following a newly discovered lens east and south. In this part of the mine there is a lens of ore 16 feet thick west of the shaft, that going south and east carrying an average thickness of about 10 feet. This last deposit is separated from the “old south” by about 80 feet of barren ground.

At No. 7, which has been spoken of as abandoned, an important discovery has recently been made with the aid of the diamond drill. A drill hole bored at an angle of 45 degrees, cut 14 feet of ore at a depth of 100 feet under and rather to the northward of the old bottom, in which the ore had pinched out altogether. The thickness of the lens thus discovered is given with due allowance for the dip of the formation, and it is altogether probable that further borings, soon to be made, will reveal the existence of a large ore body at this point. Its exact character and location will be further determined as soon as practicable, with a view of ascertaining the most feasible plan for reaching and mining out the ore. In the meantime the ground between 5 and 7 will be similarly explored, and, it is most reasonable to anticipate, with good results. The company keeps in constant operation two of Bullock's diamond drills—one of which is a “Little Giant,” for underground work, and the other a large machine kept for boring from the surface.

No new machinery has been added during the past year, but a Rand 20x48 duplex compressor is now being placed in a separate building, the intention being to cast off those now running in connection with the main hoisting plant, and thus avoid the delays to underground work in case of accident. The mine gives employment to a force of about 450 men, and com-

menced the shipping season with stock piles closely approximating 50,000 tons. The management continues in the same hands, though Capt. Jim Pascoe has been for some months during the past winter unable to attend to his duties as superintendent, on account of ill health.

THE EAST CHAMPION MINE,

After a checkered career, in which the principle of how *not* to do it mostly characterized the management, has at last fallen into the hands of men who know and will prove its value as a mining property. The mine was opened in the winter of 1872-3 under the superintendence of captain John Sweeney, an experienced miner, who mined and shipped 10,426 tons the first year. Captain Sweeney was not allowed to exercise his own good judgment in the opening of the mine and its subsequent operation—the shareholders, who were furnacemen, bought the ore at a price which, had it been paid, would have covered all the outlay for buildings and cost of operation, and left a small surplus from the first year's earnings. The panic coming on in the fall of 1873, however, the shareholders who had bought the ore, and who owned the controlling interest in the mine, "settled with themselves" at a price far below that originally agreed to be paid, and thus threw a burden of debt upon the mining company from which it has never been able to recover—though, if properly wrought, the mine could have been made to clear up all indebtedness long ago. Captain Sweeney, finding himself hampered, finally resigned, a less competent superintendent took his place, and from that time forward the mine has never had a fair show, if we except the short period during which Capt. George Mitchell had it in charge. In the meantime, though only spasmodically wrought, its product has been as follows:

	Gross Tons:
1873.....	10,426
1874.....	227
1875.....	3,346
1876.....	7,715
1877.....	14,495
1878.....	5,401
1879.....	4,029
1880.....	10,217
1881.....	3,408
Total.....	64,264

In this connection it is proper to say that the product of 1881 was all mined during the winter, the mine having lain idle during the whole of last summer. Recently, acting under the advice of Messrs. A. Kidder and Capt. Jas. Pascoe, of the now celebrated Champion mine, Messrs. Spear and Case secured a lease of the property, and at once arranged for its thorough exploration with a diamond drill. These explorations have been made under the direction of captain Pascoe, and have thus far been of the most satisfactory character, fully corroborating, as they do, his oft expressed belief that the property is a very valuable one. Working from the 2d level of No. 3 pit, the drill cut 6 feet of first and 13 feet of second-class ore in the first hole, the supposed hanging wall being nothing but a stratum of slate about 6 inches thick, immediately beyond which is the first-class ore referred to. This drill hole, which the record kept refers to as No. 1, runs horizontally north from a point about 20 feet east of the skip-road. No. 2 was started from nearly the same point and run northeast with the same gratifying results. No. 3 is directly under the skip-road, and cut about the same thickness of first-class and 11 feet of second-class ore, boring due north. Nos. 4 and 5 were started from the east end of the pit and run north and north-east, cutting about 4 feet of clean and 36 feet of second-class ore. No. 6, which has a more easterly direction passed through 67 feet of ore most of which, however, is second-class. The drill is now boring due south and is in mixed ore. These explorations will be continued until every part of the property is thoroughly tested, it being the intention to bore the next hole perpendicularly through the horse of rock which displaces the ore on the second level of No. 2. The discoveries already made, taken in connection with the fact that there is 7 feet of clean ore in the bottom of No. 2, and that the needle shows an attraction of 85 over the quartzite west of the old workings all the way to the Champion line, gives reasonable assurance that a valuable deposit will be found at no great depth below the old bottom, or at least as soon as the miners get into settled ground—the formation thus far giving evidence of having been subjected to unusually great disturbance. Aside from this, however, the drill has already discovered sufficient first-class ore to give assurance of a handsome product from the very start, and we shall not be

surprised should a dividend be announced as forthcoming at the close of the year.

The results above stated having been secured by the aid of the diamond drill, the lessees determined to organize a company, and, accordingly, the articles of association of the East Champion Iron Company were duly executed and filed, Messrs. A. Kidder, Jas. Pasco, J. R. Case, F. B. Spear and R. P. Travers being named as directors for the first year. Five thousand shares of the capital stock were set aside to be sold for working capital—2,000 to be sold immediately, and the balance as the necessities of the company may require. It is more than probable that the sale of the first two thousand will supply all the working capital required, as it is positively certain the mine can be made to more than pay expenses from the start. Captain Edwards, an experienced miner from the Champion, is in charge of the work. The mine is fully equipped with the requisite machinery for hoisting and pumping, it is in the hands of an able and energetic management, and the MINING JOURNAL will miss its guess if the East Champion does not come to be looked upon, in the near future, as one among the most valuable iron mines of the district.

THE ARGYLE MINE,

originally opened by the Pittsburgh & Lake Angeline Iron company, and until recently known as the Edwards, was, in the spring of 1881, purchased by some Detroit capitalists, who organized the Argyle Iron company with the following officers:

President—DON. M. DICKINSON;

Vice President—SIGMUND ROTHCHILD;

Treasurer—ALEXANDER H. DEY;

Secretary—DAVID R. SHAW;

General Manager—W. W. WHEATON.

The mine not having been wrought for a year previous to its purchase by the Argyle company, the new owners found the pits full of water, the pumping out of which occupied the greater part of last summer, actual mine work not being commenced until late in August of last year. The mine being unwatered, an examination showed it to have been subjected throughout to the "gouging" process, and in the worst possible condition for the resumption of mining operations. The skip-roads were in bad shape, and instead of there being any stopes,

the bottom levels had actually been gouged out several feet below the level of the tram ways, and the superintendent found many unexpected obstacles in the way of an accomplishment of profitable results in the immediate future. From that time to the present operations have been mainly confined to sinking, drifting and opening up stopes for future work, in the course of which, however, more than enough ore has been raised to meet the expense, which has been fully as great as that ordinarily attendant upon the opening of a new mine. Capt. Bale has made his work tell to good advantage, however, and an examination of the mine shows it to be now in a condition to assure a fairly profitable season's work.

The annual product of the Argyle since the beginning of operations in 1865, has been as follows:

	<i>Gross Tons.</i>
1866.....	2,843.
1867.....	4,928.
1868.....	17,360.
1869.....	19,151
1870.....	24,232
1871.....	26,437
1872.....	28,380.
1873.....	38,968.
1874.....	2,849.
1875.....	12,804.
1876.....	19,330.
1877.....	10,419.
1878.....	10,351
1879.....	5,455.
1881.....	4,584.
Total.....	228,091

It will be seen that, notwithstanding the bad condition of the mine and the fact that most of last summer was consumed in unwatering the shafts and pits, 4,584 tons of ore was mined and shipped before the close of navigation. There was in stock at the mine at the time of the writer's visit about 5,000 tons of ore which had been taken out in the course of the preparatory work which had been going on during the winter.

Going down No. 3 shaft 575 feet, on the dip of the formation, we reach the bottom, or 6th level, which is 60 feet below the one existing at the time the present owners came into possession. On this bottom level the stopes east and west of the skip-road have just been commenced. On the level above the miners are at work on stopes some distance back from the

skip-road, east and west. The workings on this 5th level, east of the skip-road, show about 15 feet of ore for a distance of 40 feet, where it narrows down to from 8 to 10 feet, and finally breaks up into small and unworkable veins or seams, beyond which a drift 50 feet in length again reveals 8 feet of clean ore. It should be stated, however, that 40 feet east of the skip-road what now appears to be the main ore body breaks away north into the hanging, but the indications are that it takes the form of a semi-circle and unites with what is called the new discovery at the east end of the drift, if, indeed, the two are not one and the same lens. It would seem that there is here a run of ore east of the shaft at least 120 feet long, still continuing east, and varying from 8 to 15 feet in thickness, all of which remains unbroken between the 5th and 6th levels. West of the skip-road the ore has been stoped away on the 5th level a distance of 30 feet, at which point there is a face of ore 20 feet wide, in the center of which, however, there is a wedge of rock 6 feet wide at the top of the stope, but cutting out entirely 4 feet above the floor, which is pretty conclusive evidence that nothing but clean ore will be found in the stopes now being started on the 6th level. This west stope on the 5th level extends 65 feet further west to a crossing of rock which divides No. 3 from old No. 6, where the slate ore occurs, and which has been gouged out to a depth of 25 feet below the 5th level, so that it cannot be economically wrought until reached on a still lower level. A short distance west of the shaft the vein or lens branches off into the so-called foot-wall. This branch vein carries a width of about 12 feet, and there is nothing but clean ore to be seen between the walls. A diamond drill hole, bored from a point in the north lens about 60 feet west of the shaft, south at right angles with the dip of the formation, after passing through 25 feet of rock, cut 12 feet of clean ore, beyond which there is 8 feet of ore slightly mixed with jasper. This is, in the writer's opinion, simply an extension of the south branch of the lens, the dip of which would seem to indicate that the intervening rock is simply a horse, and that the two ore bodies may unite at a greater depth. When the stopes on the 6th level are fairly started there will be six in all, from which a product of not less than 20,000 tons may reasonably be expected the present season, including, of course, that mined during the winter. It will take a full year, however, to put the

mine as a whole in fair condition for the most profitable production.

In No. 2, which is down to the 5th level, there is a lens of slate ore 5 to 6 feet thick, the length of which, however, is unknown. East of No. 3 shaft-house some ore is being mined from an open pit, from what we take to be the roof of that part of the underground workings, though the superintendent thinks differently. There is here, however, a vein or lens about 8 feet thick, branching off into the foot-wall from old No. 4 shaft, which will be thoroughly explored with the diamond drill, as will the ground in the swamp north of the railway track, where the needle shows very strong magnetic attractions.

Altogether, there is a much larger show of ore at the Argyle than the writer was inclined to believe. There is certainly enough now in sight to insure a paying mine from this time forward, and if the diamond drill, soon to be put in operation, does not reveal something of still greater value the circumstance will be an exception to the general rule in this section. Having laid a wager with one of the owners against the chances of the mine being made to yield a product of 25,000 tons in any one year previous to 1885, we are now prepared to hedge a little and double the bet the other way on 50,000.

The mine at present gives employment to about 75 men, which force will be increased as fast as new ground can be opened and room made for them. The plant of machinery embraces one of Merritt's 18x30 engines and four 5-foot V friction drums, only three of which last are in use.

THE HUMBOLDT MINE

Now consists of what last year was referred to as the "new discovery," which is located just east of the Republic branch of the M., H. & O. R. R. and around the west end or curve of the hill in which the Edwards and "old Washington" are situated. All the other pits have been abandoned, though preparations are making to test old No. 2 (in which there is a short 8-foot lens of ore), with a diamond drill. Though very promising, the "new discovery" does not look so large as at the date of our last annual review, when there appeared to be nearly, if not quite, 75 feet of ore in the open pit, measuring across the formation. There was, however, what some miners call a "slop-over" on the foot-wall, and in sinking the lens settled down to from 20 to 25 feet be-

tween well defined, though very irregular, foot and hanging-walls. It is proper to say, however, that the deposit has been opened up over a much greater length, and that the mine as a whole is in a condition to very nearly double her last year's product, the winter's accumulation amounting to very nearly, if not quite, 15,000 tons. Mine work is being prosecuted in three pits—Nos. 2, 3 and 5—the first named being the most south-easterly, and the last nearly 900 feet to the north-west. Going down the ladder in No. 2 shaft, we reach the bottom, or floor of the 2nd level, at a depth of 150 feet. We here find 2 50-foot stopes, and the shaft sinking to another level. The first level of 40 feet has all been stoped away south-east about 80 feet to where the ore pinched out, and the same distance north-west to a connection with No. 3. South-east of the shaft the ore body is from 9 to 15 feet thick, while to the north-west to and through No. 3 the average is not less than 15 feet. At the south-east end, where the ore pinches out on the first level, a drill hole, bored from the surface at right-angles with the formation, cut 12 feet of ore in the next lower level, which shows that either the ore pitches rapidly in that direction, or else that the rock which cuts out the ore above is merely a horse, beyond which the ore will again be found. Most of the ground on the 2nd level remains to be broken, and when No. 2 shaft and winzes are down to the 3rd level there will be four 50-foot stopes in this part of the mine, from two of which they are now throwing down and hoisting out about 100 tons per day.

No. 3 is the open cut spoken of in our last annual review, and which was so wrought to a depth of about 80 feet, when it was determined to adopt the underground plan. They are now sinking for stopes, the so-called shaft being down 50 feet below the old bottom, and the winzes well under way. When these are completed the necessary stulls and lagging will be put in, and the old open pit filled up with waste rock. As stated, the ore body here is from 20 to 25 feet thick, but seems to narrow down considerably to the north-east, though this may be occasioned by a bulge in the foot-wall, as is the case at several other points in the underground workings.

About 800 feet north-east of No. 3 a shaft called No. 5 is down 60 feet, and shows about 3 feet of ore in the bottom—probably the end of a lens, as in driving a stope south-easterly only a short distance the ore has widened out to 8 feet.

Whether this is a separate lens or continuous with that of Nos. 2 and 3 has, of course, not yet been determined, there being 800 feet of unexplored ground between. The ore is a very fine, first-class slate.

As a whole, the Humboldt is a most promising mine, and the results certain to be achieved the present year can but be of the most gratifying character, particularly to shareholders.

The mine force, all told, numbers about 160. John B. Maas is general manager, and John Hosking, an experienced miner, has charge of mining operations. The plant of machinery embraces one 16x24 engine, two 4-foot clutch drums, (formerly in use at No. 1 Washington), and an old style Delamater air compressor, which last furnishes the power for three of Ingersoll's power drills.

Since the commencement of operations in 1864 the annual product of the Humboldt has been as follows:

	<i>Gross Tons.</i>
1865.....	4,782
1866.....	15,150
1867.....	25,440
1868.....	35,757
1869.....	58,462
1870.....	79,763
1871.....	48,725
1872.....	38,841
1873.....	38,014
1874.....	27,890
1875.....	9,642
1876.....	3,333
1877.....	16,545
1878.....	23,920
1879.....	18,204
1880.....	14,726
1881.....	26,302
Total.....	485,495

The diamond drill is being extensively employed the present season in further locating the "new discovery," and in explorations elsewhere on the company's leasehold, and we confidently anticipate good results.

THE MICHIGAMME MINE

Increased her product to the extent of nearly 5,000 tons last year—not doing quite so well as our last annual report possibly gave shareholders reason to expect. The anticipated enlargement of the ore body in the east end of the mine was not realized, though the outlook in the present bottom is very encour-

aging. A very large increase cannot, however, be looked for until a contemplated change in the system of mine work is fully inaugurated. The plan has heretofore been to sink for stopes and do all necessary dead work during the winter; that is, to prepare a level, leaving most of the ore to be taken out during the season of navigation. In this way work could only be prosecuted on one level, and with a limited number of men. It is now proposed to continue this preparatory work without intermission, so that instead of one there will always be two or three levels ready for stoping, and on all of which, if deemed advisable, mine work can be prosecuted at one and the same time. The mine can be made to produce much more largely, and any plan by which the great ore body, which will undoubtedly be found below the bottom of the present workings, can be more rapidly reached, is to be commended. Such a plan is the one which Mr. Christopher, the very capable mining captain, now urges upon the management. The only question involved is whether a more rapid development of the mine, and consequent enlargement of the product, is desirable, or whether it will be more profitable to make haste slowly and by winter and summer jerks. It is no reflection on either the general or local management to say that the Michigamme mine ought now to be in a condition to produce at least 100,000 tons annually; that it is not is solely due to the conservatism which has hitherto prevailed in the conduct of its affairs—the management preferring to feel its way along slowly and surely to the great results which are sure to be ultimately attained. The chief end to be attained through the new system referred to is the more speedy accomplishment of such results—that, and nothing more.

Since the first opening was made at the Michigamme, in 1872, the annual product has been as follows:

	<i>Gross Tons.</i>
1872.....	141
1873.....	29,107
1874.....	45,294
1875.....	44,763
1876.....	70,074
1877.....	28,238
1878.....	58,622
1879.....	56,970
1880.....	52,766
1881.....	57,272
Total.....	443,247

Since our last annual review a change in the designation of the shafts has been made, the one at the east end, near the lake, and which at that time was down 90 feet in mixed ore, now being designated as No. 1, and the others following in regular order to the west. This shaft is now down 156 feet, the last 8 feet being below the present working level. On the upper level there was an average of about six feet of ore, which was worked out to a distance of 25 feet east and 60 feet west of the shaft. On the present level there are east and west stopes 50 feet high, and, so far as known, of the average width of 6 feet, though in the bottom of the shaft, 8 feet below the floor, there is 12 feet of clean ore, which, taken in connection with the fact that the diamond drill showed 27 feet of ore at another point of about the same depth, clearly indicates a sudden widening of the lens, and that a very material enlargement of the stopes may be expected in the next level.

In No. 2 (No. 1, last report,) the last year's level has all been taken up, and the shaft carried down 30 feet, where it has been stopped temporarily because of the inability of the pump to raise water from a greater depth. As soon as the 30-foot stope thus made is driven back far enough to afford room for a large bucket pump, the shaft will be sunk 30 feet deeper, and 60-foot stopes taken up east and west of the shaft. There is here a body of ore about 12 feet thick, extending 65 feet east and 125 feet west of the shaft, the ore being cut off at both ends by crossings or horses of rock, beyond which, however, the ore is again found. These horses, or crossings, dip towards each other, which accounts for the apparent shortening up of the ore body, which, however, shows no diminution, the loss inside the crossings being fully equalized by the extension of the ore beyond them at either end. The ground at this point is somewhat unsettled, and it is believed the ore body will be found more regular, if not considerably larger, in sinking one or two more levels, the indications being that the rock horses, or crossings, will cut out at no very considerable greater depth.

No. 3 skip road is down 125 feet in the hornblende, and will be leisurely pushed along to a depth corresponding with the bottom level of No. 4.

No. 4, from which by much the larger part of last year's product was mined, looks better than ever, the lens continuing to lengthen out, in proportion as its pitch to the east carries it.

under the hornblende and mixed ore spoken of in our last annual report. The shaft and winzes have been dropped another lift of 50 feet, that being the height of the stopes in a lens which varies from 25 to 35 feet in thickness, and which, on the next level above, was over 400 feet in length.

In Nos. 5 and 6 no work is being done, though enough ore still remains to afford employment to a force of scrammers next summer. The diamond drill has revealed nothing new which has not already been reported. It is now boring from a point south of the railroad track, and west of the saw-mill, at an angle of 55 degrees northward under the swamp, in the hope of proving the extension westward of the basin discovered last year. At the time of our visit the drill had penetrated nearly 700 feet and was still in quartzite, under which, it is supposed, lies the diorite and below that the ore. It is hardly probable, however, that the ore will be reached, for the reason that it will be next to impossible to bore a hundred feet deeper in the same hole, though an additional engine has been called into requisition to assist in working the drill. The boring will, however, be of value, even if it does not strike the ore, in that it will demonstrate to a reasonable extent the angle of the dip below the present bottom of No. 4.

A new and thoroughly equipped machine shop is the only surface improvement worthy of note added the past year. In this shop all the repairs to machinery are made.

The working force is about the same as last year, and it is expected that the output for 1882 will just about equal that of 1881. John C. Fowle, Esq., remains in charge as superintendent, which fact may be accepted as pretty conclusive proof that his management of the mine has met with that approval due from the employer to the good and faithful servant.

THE COLUMBIA MINE

Very nearly doubled her product during the second year of the new management, as compared with the first, her shipments for the several years she has been wrought being as follows:

	<i>Gross Tons.</i>
1873.....	21,065
1874.....	35,088
1875.....	8,059
1880.....	6,663
1881.....	11,158
Total.....	82,033

As may readily be inferred from the increased output, all the changes noticeable at the Columbia are for the better. No particular effort has been made towards an immediate enlargement of the yield, the aim of the management being to first prove the probable extent of the several lenses, to attain which object a diamond drill was, and still is, employed, and with good results. During the past year 35 feet of the old bottom of No. 1 pit has been taken up, so that its depth is now 145 feet. In going down that distance the ore has very materially improved both in quantity and quality, the lens having gained 20 feet in length, and the average width having increased to about 15 feet. A diamond drill hole cross-cut the vein or lens 100 feet below the present bottom, and shows 20 feet of ore at that depth, making allowance for difference between dip and angle. This shows conclusively that the lens increases in length and breadth in sinking, thus giving promise of a steadily increasing product from this part of the mine.

Nothing has been done in No. 2 the past year, but it is now the intention to run a drift through the rock crossing at the west end of No. 1, striking the ore lens in No. 2 about 80 feet below the old bottom. It is hoped that the lens, which is only 6 feet wide, about 50 feet long and 60 feet deep, on the old bottom, will be found considerably larger at a depth corresponding with that of No. 1—it is too small on the upper level to be profitably wrought as a separate pit.

No. 3 pit is down 140 feet, and mining is now being done in a lens of ore 11 feet wide and about 160 feet long. This is the new lens which was discovered by boring into the hanging-wall last summer, and takes the place of the old one described in our last report, and which has narrowed down to almost nothing, the ore being of second-class quality. The new lens, however, which most probably extends under No. 4, is entirely clean, and the ore first-class in every particular, except that it carries too much phosphorus for Bessemer purposes. No work is being done in No. 4 which, on the upper level, is divided from No. 3 by a rock-crossing, the ore having cut out shortly after our last report went to press. The writer ventures the opinion, however, that the new lens in No. 3 will be found not only continuous with the rapidly growing ore body in No. 1, but likewise extending itself under and beyond the old bottom of No. 4

—constituting what will ultimately prove to be a very large deposit.

In No. 6, which is worked out to a depth of 130 feet, a square break occurred in the hanging, some distance above the present bottom, while the foot-wall came in more regularly, the ore body gaining considerably in thickness—the width above the break averaging about 10 feet. It is now the intention to run a drift north-west in the vein or lens, under the lake, in order to prove its extent in that direction, and, if found advisable, to extend the underground workings. In the meantime, No. 5, in which the ore cut out, will be thoroughly explored with the diamond drill.

A perpendicular drill hole is now going down a short distance south-west of the engine house. At the time of the writer's visit the drill had reached a depth of 230 feet, and the cores showed a very considerable change in the dip of the formation to the south—a change that was likewise observable in the borings under No. 3. That the drill will strike the ore in another hundred feet is reasonably certain, and we shall not be astonished if a series of such borings shall demonstrate the existence at this point of a basin of ore of which the present workings but show a part of the upturned rim or edges. We look for some very important and valuable discoveries at the Columbia within the coming twelve months.

Altogether, the mine has very materially improved during the year past. The writer can see no reason why, with no untoward circumstances intervening, the Columbia should not close the shipping season next fall with a product of at least 30,000 tons.

NEGAUNEE HEMATITE RANGE.

THE MILWAUKIE MINE

Has not proved such a huge bonanza as was anticipated at this time last year; nevertheless it may fairly be considered one of the best hematite mines of the district. It is evident that the great bulk of the ore body lies much deeper than the bottom of the present workings, a belief which is sustained by the more recent developments at the McComber, close by, where great bodies of clean ore are now being wrought far below the bottoms of the old abandoned open pits. The history of the Mc-

Comber is most likely to be repeated in the future record of the Milwaukie.

The product of the Milwaukie, since the commencement of mining operations in the fall of 1879, has been as follows:

	<i>Gross Tons.</i>
1879.....	941
1880.....	13,142
1881.....	31,635
Total.....	45,718

The workings at present consist of seven pits, numbered from 1 to 7, respectively. In No. 1, where at the date of our last annual review the ore had narrowed down to a small thickness at a depth of 40 feet, about 1,000 of the 3,000 tons then supposed to be remaining in the bottom, has been mined out—the balance can only be reached by drifting under it from No. 2. In the latter pit, in sinking for a stope at the east end, a horse of rock was encountered at a depth of 22 feet below the old bottom, which extended clear across the deposit, and had the appearance of cutting out the ore entirely in that direction. An Akron drill was put to work, however, and the rock was found to be only eight feet thick, the drill penetrating 35 feet of clean ore beneath it. There is in this pit at present a stope of clean ore looking west, which is 22 feet high and 45 feet wide. It is now the intention to sink a shaft through the rock at the east end, and crib it up to a sufficient height above the present bottom to catch all the debris which may fall away from the walls, supply it with a skip-road, and thereafter pursue a regular system of underground mining.

In No. 3, originally known as the Ryan pit, and in which there was such an immense show of ore at this time last year, the ore rapidly narrowed down until there was not more than 4 feet to be seen in the bottom. In sinking 42 feet, however, the ore becomes clean again, and apparently widens out, though as yet no cross-cut has been made to determine its exact width. This pit will be supplied with a timber shaft, the same as at No. 2, and hereafter will be wrought on the underground plan. The exploration shaft in the bottom gives unmistakable evidence of a large deposit of clean ore under the old bottom.

In Nos. 4 and 5 the ground is badly broken up, and very little ore is to be seen. The miners are simply following what

little ore there is wherever it leads them in the hope of finding something better.

In No. 6, where there was 100 feet of ore last year, the foot-wall came in rapidly, and cut the ore out altogether. A cross-cut was then made into the foot-wall without profitable result. They then went into the hanging through 10 feet of soapstone and into 22 feet of clean ore, which appears to be a lens lying parallel with the one which has been worked out. A drift 30 feet long has been made in the newly-discovered lens, and from it a shaft will be sunk 40 feet in the ore, and supplied with a skip-road, the intention being to make an underground pit of it.

No. 7 is an open pit 60 feet deep, from the bottom of which a drift has been driven to the west, in ore, 100 feet, at which point rock was encountered. This lens is about 150 feet in length, and so far as known, about 43 feet wide. In "raising up" at the west end of the drift referred to, the ore was found to extend all the way up to the drift covering which is about 10 feet thick. A shaft is now being cribbed up, and a skip-road put into this pit, which is expected to supply a goodly proportion of the product of the mine the present year. Shipments commenced the present season from stock piles aggregating about 10,000 tons, and the season's output will be about the same as last year, barring unforeseen accidents.

The plant of machinery embraces two double engines—one 50 and the other 70 horse power—three 5-foot drums, and a small portable hoisting engine at No. 7, which last is soon to be replaced by a 50-horse-power double engine and 5-foot drum, located in the main engine house. Jas. F. Foley retains the general management.

THE CHICAGO MINE

Is looking remarkably well. A shaft is down in the old bottom 55 feet, from the bottom of which the miners are raising another on the underlay of the skip-road. When the last is completed the ore will be stoped out in all directions from the one first referred to, which is, apparently, near the center of the deposit. The ore body, so far as is at present positively known, is about 100 feet long and 65 feet wide, but it is more than probable that it will be found extending eastward to a connection with the newly-discovered Star mine. The latter is in much

lower ground, and all the latest developments on this range justify the belief that either the largest deposits are in the low ground, or else that those in the high ground lie at a much greater depth. That the latter theory is most likely to be the correct one would seem to need no other corroboration than is to be found in the large bodies of clean ore at the McComber, which were neither so large or uniform a hundred feet higher up. Promising as the Chicago looks, we venture the opinion that not more than a scratch has yet been made in the deposit, which, unless all signs fail, will be found a very large one at a depth corresponding with the present levels of the McComber. A single 4-foot drum does the hoisting at present, and will doubtless be sufficient for the work until the company concludes to sink one or two shafts into a deposit in the mere outcrop of which the present workings are located.

THE M'COMBER MINE

Is in condition to mine and ship a larger product this year than ever before, though now in her thirteenth year of development. Since the commencement of operations in 1870 the annual yield of this mine has been as follows:

	Gross Tons..
1870.....	4,866
1871.....	15,942
1872.....	24,153
1873.....	38,969
1874.....	2,642
1875.....	10,407
1876.....	17,276
1877.....	19,691
1878.....	30,180
1879.....	28,962
1880.....	31,206
1881.....	28,051

Total..... 252,345

Like all the other hematite mines in the district, work at the McComber was for a number of years prosecuted in open cuts, of which there were at least a dozen, all of which have, however, with the exception of No. 5, been abandoned, either because of the exhaustion of the ore body, or because of the dangerous character of the walls. No. 5 is the most easterly of the old workings, save one, and presents the same general features as at the date of our last annual review, except that from 10 to 15 feet of the old floor has been taken up, and the ore is

found to be dipping more rapidly under the hanging, to the south. There is here a lens of ore about 200 feet in length, and of the average width of about 15 feet, from the bottom of which a shaft or winze is down 30 feet, and from which the present floor will be stoped out during the summer. It is not probable that this pit can be successfully wrought on the present plan beyond the present year; the better, safer and more economical way will be to adopt the underground system, as has been done at the more westerly pits, where three shafts have been sunk, and large bodies of ore opened up below the bottoms of the old open cuts.

Since our last report a new shaft, known as No. 8, has been put down about 200 hundred feet west of No. 3, with which it was connected on the 90-foot level by a tunnel 8 feet wide, to a depth of 109 feet. In No. 8 there are three stopes—one 14 feet wide and 14 feet high, working east toward No. 3; one working west from a point about 25 feet higher up in about 6 feet of ore, and a back stope in the tunnel. The plan is, the shafts being down and connected by a tunnel, 14 feet of ore is stoped out the whole width of the deposit, after which the miners go up 8 feet and room out 14 feet more, leaving the 8 feet as an arch to support the walls.

No. 3 shaft is down 160 feet, 30 feet below the level of the tunnel connecting it with No. 8, and the ore is being stoped out to the west and south-east, on the 90-foot level, while a drift from the bottom is being made south-east with a view of taking up another stope of the same size. This drift will pass through 24 feet of mixed ore before it reaches the lens, which is evidently a deposit separate and distinct from the one in which the shafts are located, as is shown by the fact that a drift south-west from No. 3 shaft, and now nearly through to No. 8, passes all the way through good ore, with the exception of the 24 feet of mixed ore referred to, and which appears to separate it from the other lens. There is at this point, undoubtedly, a very large amount of clean ore, as may be inferred from the fact that about 60 tons a day are being hoisted in buckets from these two shafts.

No. 6 shaft has been abandoned, so far as its use for hoisting purposes is concerned, and is now only used to supply the boilers with water.

A new discovery was recently made on the Manganese line, which

promises exceedingly well, though the extent of the deposit is not definitely known, yet altogether, the McComber may be considered a more valuable mining property than at any previous period since the commencement of operations. It looks to the writer as if the main ore deposits were but just being reached by the shafts and drifts. The old open workings were in high ground, and in the opinion of the writer were made in what can only be considered isolated out-croppings of the larger and cleaner deposits which lie at a much greater depth—at least such is the belief justified by the present condition of the underground pits.

The McComber gives employment to about 75 men all told. Harry Merry, son of Capt. Henry Merry, is local agent, and Capt. Charles Fox, who has had fourteen years' experience as a foreman in the Jackson mine, is mining superintendent. No new machinery has been added the past year. Capt. Fox estimates the product for 1882 at about 35,000 tons, but we can see nothing, save unforeseen accident, to prevent a yield of at least 40,000.

THE PENDILL MINE

With its one shaft, and single hoisting drum, made a good showing in 1881, and promises to do better this year. The shaft is now down 190 feet, but as yet there is nothing regular in the formation. The ore lies in irregular and detached lenses, or rather pockets, new ones being found as fast as the old ones are exhausted. For this reason no intelligible description of the underground workings can be given; they consist simply of the shaft, and drifts here and there into pockets of ore which, being worked out, are filled up again with the waste rock taken from the drifts driven in search of others. These pockets, however, are large and numerous enough to supply as much ore as can conveniently be handled through one shaft—no rock is hoisted to the surface, it being all stowed away below and held in reserve for filling in wherever most necessary or convenient. The monthly product is about 1,800 tons. The annual yield of the Pendill has been as follows:

	<i>Gross Tons.</i>
1878.....	4,000
1879.....	12,549
1880.....	3,959
1881.....	13,586
Total.....	34,094

An exploration shaft is now going down some distance to the south-east, near the carriage works, in the hope of catching the main deposit, though why the management should indulge such an expectation is not entirely clear to the writer. It is wholly probable, however, that captain Richard Bryant, who is an experienced miner, knows what he is doing. The present workings, it is fair to assume, are not all there is of value to be found in the Pendill.

The mine gives employment to about 35 men, and present indications point to a product of something like 20,000 tons the present year.

THE ROLLING MILL

Mine is not working, for what reason we are not informed—probably on the same principle that a certain Detroit hotel is most always sometimes generally minus a tenant. The annual product of this mine has been as follows:

	<i>Gross Tons.</i>
1871.....	236
1872.....	6,772
1873.....	11,319
1874.....	16,643
1875.....	37,806
1876.....	53,265
1877.....	38,121
1878.....	30,773
1879.....	10,039
1880.....	15,172
1881.....	1,668
Total.....	221,814

THE BAY STATE

Is the new name given the Indiana, the lease of which is now owned by a corporation of that name. No work is being done at the mine at the present time, but it is understood that the new owners will renew operations shortly with a vigor hitherto unknown in the history of that leasehold. They have a very fine show of good ore, and it is altogether probable that the Bay State may hereafter be numbered among the reliable producing mines of the Negaunee Hematite range. It has so far yielded 14,799 tons of ore, all of which, however, was not strictly first-class.

THE STAR MINE

Is a new and promising property, the lease of which is owned by the Star Iron Company, of which J. B. Maas, of Negaunee,

is president. The leasehold embraces the south half of the south-west quarter of section 8, town 47, range 26, the tract adjoining the Chicago on the east. Explorations were commenced at a point about the centre of the tract, where a shaft was sunk about 50 feet in mixed ore and diorite, from the bottom of which a drift was run north 30 feet through the same kind of ground, and 20 feet through soapstone, when ore was encountered, in which last the drift was continued 72 feet, that being the width between well defined walls. A drift was then run 60 feet west on the foot-wall side of the deposit, and another 25 feet east, at which last point a shaft was "raised" to the surface, all the way in ore, except about 9 feet of drift covering. Test pitting is now in progress further east, the ore thus far having been traced 380 feet from the raised shaft. The ore is a very fine looking hematite, that going east from the shaft being very similar to the Milwaukie mine, and that going west closely resembling the Chicago, with which the Star deposit is most probably continuous. It is the intention to more fully test the extent and quality of the ore by sinking another lift, and drifting and cross-cutting at a depth of at least 100 feet. The deposit lies in low ground, but a $4\frac{1}{2}$ Knowles pump has been found amply sufficient to keep the shaft and drifts dry. A small engine and drum, of the Rochester make, does the hoisting. Transportation will be supplied by the C. & N. W. R'y, the Foster mine branch of which passes through the tract, and within a stone's throw of the workings. The chances are all in favor of the development of the Star into a paying mine, and that right speedily.

THE NEW YORK HEMATITE MINE,

Formerly known as the Grand Central, is now owned in leasehold by Adams & Foley. It was supposed, and positively asserted by a former superintendent, that all the ore had been mined out of the main, or No. 1, pit, but when the present lessees took the mine they concluded to sink at least a short distance into the bottom, which was apparently all rock. The very first blast revealed the ore underneath, and the bottom is now all ore, and the deposit appears to be rapidly widening out. The formation appears to swing around to the east, and the fair inference is that the deposit will be found continuous with that of No. 2, in which there is a large show of ore. A new

skip-road has been put into No. 1, and is now in operation, a 5-foot drum doing the hoisting. No. 2, which is a large open pit, did not look very well at the time of our visit, from the fact that the bottom was pretty well covered up with waste rock which had been taken down from the foot-wall to make place for the new skip-road then being put in. We could see enough of this bottom, however, to convince us that it is nearly, if not quite, all ore, while two drifts, which were in progress east and south, were both from 25 to 30 feet in ore of apparent good quality. A new discovery was made on this property further east sometime last fall, but not enough work has been done in it to enable us to form an opinion as to its extent or value. The new and promising discovery made near by by Mr. Shadt, of which mention is made elsewhere, would seem, however, to warrant the belief that it may prove to be a lens or deposit of very considerable size. As a whole, we regard the New York Hematite as one of the most valuable properties on the Negaunee range—a belief of ours which we regard as certain to become a fixed fact as soon as, if not before, a depth corresponding to that of the McComber and Milwaukie is reached in the progress of mining. This theory is corroborated by the history of the McComber, more particularly, at which mine the largest and best deposits have been found and are now being wrought below the bottoms of pits that were supposed to be exhausted. The New York Hematite is in the hands of lessees who will do no desultory scratching on the surface, but who will lose no time in getting away from the cap-rock with which the deposits of this range are more or less mixed or covered up. The mine has a prosperous future before it, or we are sadly mistaken in our honest opinion based on close personal examination.

THE MANGANESE.

A most promising discovery has been made by J. W. Schadt, Esq., on the middle "forty" of the Manganese tract, just north of the high railway trestle of the Milwaukie mine branch. At this point two shafts are down 35 and 65 feet, respectively, one on the hanging and the other on the foot-wall side, though not immediately opposite to each other. The deepest shaft is 56 feet in clean ore, and a drift from the bottom, across the formation, shows 25 feet of ore between the walls. The other shaft is 26 feet in ore, while a drift now in progress, and going with

the formation from the bottom of the deep shaft, is 18 feet in ore. The trend of the formation is from north-west to south-east, and the deposit is probably a continuation of the newly discovered deposit of the New York Hematite, which is but a few rods to the north-west of the shafts referred to. The ore is a red and brown hematite, and apparently of excellent quality. Another new deposit of ore carrying a large percentage of Manganese is being opened on the west 40, near the McComber line. This new find is spoken of in connection with the McComber, it being immediately on the line, and apparently about equally divided between the two properties.

THE BARAGA,

Which showed considerable promise last year, has been temporarily, if not permanently, abandoned by the present holders of the option, though it has not by any means had a fair test in the way of exploration. Some few pits and a shaft were sunk on the east side of the track, but that part of it lying nearest the newer developments of the Manganese and New York Hematite has never been examined. It is a general belief among mining men that a very little money, judiciously expended, is all that is necessary to develop something of value on the Baraga tract.

THE ORION

Is idle, as is also the Tracy. These are good properties, and we learn that arrangements have been concluded by which work will be resumed and actively prosecuted at the Tracy.

THE NORTH RANGE,

So called, extends from Ishpeming through the north part of town 47 and south part of town 48, ranges 28 and 29, to and beyond the east end of Lake Michigamme, embracing within its limits, so far as developed, the St. Lawrence, Excelsior, Boston, Sterling, Mesnard, Jim Pascoe, Dalliba, Northampton and Marine mines, together with other promising properties as yet only partially developed. Of the mines named, the Excelsior, though the oldest, is not now working, the ore being rather lean; the St. Lawrence is a new mine the ore of which is a soft hematite of fair quality; further west are the Dexter and Dey properties, on which both hard red specular and hematite ores have been found in boring with the diamond drill, and on

which work preliminary to active mining operations is in progress; still further along are the Boston and Sterling, and some three or four miles beyond the others named as belonging to this range, and the ores of which may be properly denominated a hard hematite, averaging well in metallic iron, but too high in phosphorus for Bessemer purposes.

THE BOSTON

Has so far made the best record of any mine on the north range, though some of the others promise a much larger product, in the near future, than can reasonably be expected from the Boston. It is not a large mine, nor is it likely ever to become one, if a comparison be made between it and the Lake Superior or Republic; it is, nevertheless, a most valuable property, and one that cannot prove otherwise than largely remunerative to its owners. The ore is of the very best quality, as rich as any in metallic iron, and lower than most others of the district in silica and phosphorus, for which reason it will always command a ready sale at the highest price. The company owns the fee, which is another point in its favor, as compared with the other mines on this range, most of which are only held and operated under leases for a term of years.

The principal workings at the Boston cover a length of about 230 feet on a well defined vein or lens, lying between walls nearly vertical, and which on the present working level, 110 feet below the surface, narrows down from 12 feet in thickness at the west end to 5 feet near the center, from this point again widening out to 10 feet at the east end. The trend is nearly east and west, the dip slightly to the south, and the pitch about 45 degrees to the east, as is now plainly to be seen in the workings at the east end—it will be remembered that there was some dispute on this point at the time of our last annual review. These workings were commenced in a mere streak or seam of ore, which has gradually widened out to the dimensions stated, while in sinking the last 30 feet a very considerable gain has been made in the length of the workings, owing to the easterly pitch of the lens. There are in these workings two 15-foot stopes, at present, and sinking for two others is in progress. The hoisting is done in buckets, the point at which they descend into the mine being referred to as shafts, though in fact the workings would be entirely open had not a part of them been

lagged over some distance below the surface; the only sinking done is for stopes, the whole width of the vein. It is assumed, however, that each derrick represents a shaft, of which there are three in the present workings, where there will shortly be no less than six stopes, each made as intimated above by sinking at, and working each way from, the several points from which the ore is raised to the surface. The ore is now entirely clean between walls, and requires no selection, save when a shot happens to knock down a bunch of rock from either side.

What is called the Jasper shaft, is located 180 feet east of No. 3 derrick, and is going down in jasper expecting to catch the ore on the pitch from the east end of the present workings. What is called the wet shaft is 227 feet east of the Jasper shaft, and is in ore of good quality, though not now working. During the year past one of Bullock's diamond drills has been used to good purpose in testing the depth of, and locating the vein or lens to the eastward of the wet shaft. No. 1 drill hole cut a little over 10 feet of specular, and 12 feet of hematite ore at a vertical depth of 255 feet, directly under the Jasper shaft; No. 2, which is under the wet shaft, passed through $13\frac{1}{2}$ feet of red specular ore and stopped in 27 feet of hematite, at a vertical depth of 189 feet; No. 3, 500 feet east of the wet shaft, cut 13 feet 4 inches of hard ore at a depth of 192 feet; No. 4, 500 feet still further east, proved barren. The thickness of the vein, as shown by these borings, is given as above after making the necessary deductions for angle of the drill hole. They all, with the exception of No. 4, where no ore was found, show that the lens gradually widens with depth, and that there is most probably a continuous run of ore over 1,100 feet in length, though the ore and formation at the wet shaft rather encourages the belief that it is the west end of a separate and distinct lens which laps the east end of the one in which the main workings are located.

The quality of the ore is shown by the average analyses made from the drill-cores. The specular ore from No. 1 drill hole gave an average of 67.12 metallic iron, 1.62 silica, and .006 phosphorus, the hematite 59 per cent. iron and only a trace of phosphorus. No. 2, under the wet shaft, ran from 63 to 64 in metallic iron, and very low in phosphorus; No. 3, 66.10 iron, 3.63 silica and .036 phosphorus.

At present nothing is being done to open up the deposit east

of the wet shaft, and operations will be principally confined to the original workings west of and under the Jasper shaft, the ground between the two being likewise unexplored. When, however, the management concludes to open up the new ground developed by the drill, it will be a comparatively easy task to at least double the product of the mine, which this year will closely approximate 25,000 tons. The mine made a handsome profit on its last year's yield of 14,824 tons, but no dividend was declared, the earnings being devoted to diamond drill work, the result of which has been the very great enhancement of the actual value of the mine. The total product so far has been 21,302 tons, of which 6,478 tons were mined the first year.

Fred A. Wright, a brother of the state commissioner of mineral statistics, is now treasurer and general agent of the Boston, and gives personal attention to the business affairs of the company; Capt. P. T. Tracy is superintendent. No new machinery has been added the past year, though several new buildings have been erected. The mining force numbers about 65 men, all told.

THE STERLING MINE

Shows a marked improvement. The vein continues to gradually widen out in sinking, the bottom level now showing 12 feet of clean ore at the east end and 5 feet at the western extremity of the pit. Sinking for stopes is now in progress, the so-called shaft being down about 140 feet, the intention being to carry it down far enough to open up all the ground that can be broken during the summer. The most important feature in connection with this mine is the development made by the diamond drill since our last annual report. The sinking of the iron caisson in the swamp, to which reference was made in our last annual review, proved a failure, and it was then determined to employ a diamond drill in locating and testing the vein to the westward. The first hole was drilled at a point 500 feet west of No. 1 shaft, where it was found necessary to sink 57 feet of stand pipe. Below this the drill, working on an angle of 63 degrees from the horizontal, passed 145 feet through quartzite into 5 feet 9 inches of No. 1 ore, below which it encountered 16 feet of jasper and 2 feet of soapstone, and then cut 18 feet 10 inches No. 1 specular, and 13 feet of red, lustreless hematite. No. 2 drill hole is 500 feet still further west, and, going down on an angle of 58 degrees, the diamond cut 5

feet 9 inches of No. 1 ore under 15 feet of quartzite, 88 feet of the stand-pipe being required to reach the ledge. After passing through 30 feet of jasper, No. 1 ore was again struck, through which the drill passed in a distance of 8 feet 3 inches, thence into mixed ore and jasper where it was stopped. These borings are important in that they show a continuous run of ore over 1,000 feet in length, and that there are two distinct veins or lenses, aside from the hematite, which last is of good quality, giving nearly 65 per cent. by analysis. Analyses of the No. 1 ore show $68\frac{1}{2}$ per cent. metallic iron and only .012 of phosphorus. Nothing, however, has yet been done looking to the practical development of these lenses by the sinking of the necessary shafts, but it is not to be presumed that an actual commencement in that direction will be long delayed.

Subsequent to the completion of No. 1 drill hole a drift was driven north into the foot-wall, from the west end of No. 1 pit, a distance of 38 feet, in the hope of cutting a lens corresponding with the 18 feet of No. 1 ore cut by the drill, but nothing save about 2 feet of good ore was found. A drift was also run some distance west from the west end of the pit in jasper, leaving the ore in the hanging, until it was abandoned by the former management, under the belief that the ore had cut out altogether. Subsequently the mistake was discovered, the supposed hanging-wall cleaned up, and now there is a face of clean ore 5 feet wide in that end of the pit. Altogether, the prospects for the development of the Sterling into a paying mine may be considered at least one hundred per cent. better than at this time last year. It now has a careful, intelligent management, Mr. G. W. Reed, agent and J. R. Reed, mining captain, giving to the mine their exclusive attention. The shipments last year were 4,702 tons, 797 tons having been previously mined and shipped. A comparatively small force of men—not over 40—is employed.

THE DALLIBA MINE

Shows a very marked improvement since our last annual review, at which time no ore had been shipped. The product for 1881 amounted to 10,986 tons, all of which was mined from a single pit, the hanging-wall of which has not yet been found. This is No. 1, in which a shaft had been sunk 40 feet at the time of our last report. This pit is about 100 feet long, and 70 feet wide at present, the floor being on a level with the bottom of

the shaft referred to. On this level the ore has been worked back from the foot-wall, which is on the south, a distance of, perhaps, 50 feet, where a horse of rock is encountered, behind which, however, there appears to be a very considerably body of clean ore. The bottom of this pit is all ore, with a large working face in the east end, as well as on the hanging-wall side. To all appearances the ore body at this point is at least 80 feet wide, making allowance for the horse of rock referred to; it is, in fact, the largest open hematite pit to be seen anywhere in the district. It is yielding at present about 130 tons per day of 24 hours, and when another level is ready for stoping, as it will be in a very short time, the daily product can be doubled. The shaft to the second level, in which the double skip-road will be dropped to the bottom, will give a 30-foot stope, from which the ore can be mined out in all directions, without interfering with the work on the first level, which will be supplied with a new skip-road. A new plant of machinery is now on the ground, and will soon be set up and put into operation. It consists of two engines and four 30-inch interior gear drums, one of which will be used for hoisting from the first level of No. 1 pit, and the others for the same purpose in Nos. 3 and 4. No. 3 pit, so-called, is about 400 feet east of No. 1, and No. 4 about the same distance west, in both of which shafts are going down on the foot-wall side, preparatory to the commencement of active mining operations. When these pits are properly opened up and supplied with the necessary skip-roads, we can see no reason why a daily product of at least 400 tons may not be attained. There is here, most certainly, a body of ore at least 900 feet long, and so far as known, 80 feet wide, and which can be drawn upon for a product limited only by the number of men that can profitably be employed, and the hoisting facilities.

These remarks apply only to the Dalliba mine proper—*i. e.* to the openings referred to in our last annual review. Since then an important discovery has been made about half a mile north, on the south half of the northwest quarter of section 29, town 48, range 29, where there is, apparently, a very large body of ore, which is now being prepared for mining. The workings on this part of the Dalliba, now familiarly known as the "North Dalliba," comprise two open pits about 250 feet apart, and numbered respectively 2 and 5, in which the surface drift has been

removed from what was at first thought to be large bodies of clean ore. A shaft in No. 2, which is the most easterly opening, went down through 30 feet of mixed stuff before striking clean ore, in which last it was continued 10 feet. This fact is only important as showing that the deposit is rather mixed on top, though a shaft just commenced in No. 5 shows exceedingly well, both as to quantity and quality of ore. To count on nothing but clean ore in such a large deposit as the North Dalliba, would be expecting too much, and the fact that some parts of it are capped with mixed ore is a matter of trifling importance so far as the ultimate value of the property is concerned.

This part of the Dalliba is to be supplied with a hoisting plant, consisting of an engine and two 30-inch drums, which is now on the ground and ready to be set up. The mine gives employment to a force of about 90 men, which will be increased very considerably in the near future. There is now mined and in stock about 7,000 tons, in addition to the ore shipped to St. Ignace and points below Escanaba since the close of navigation last fall, and an estimate of 75,000 tons the present year is, we think, a low one—or, rather, would be, had the necessary preparatory work been done during the past winter.

Walter Fitch, Esq., an active and efficient young business man, is local agent, and John Foley, an experienced miner, mining superintendent. Under their immediate management we look for a most creditable report from the Dalliba at the close of the year.

THE JIM PASCOE MINE

adjoins the north Dalliba on the east. The first work at this new mine was done last summer, since which time the deposit has been uncovered or test-pitted over a length of at least 1,200 feet, the surface workings showing a width of from 50 to 75 feet between walls. It has an east and west trend, dips slightly to the north, and is undoubtedly continuous with the north Dalliba deposit, No. 2 pit of which last is immediately on the line between the two properties. It lies in the north face of a high hill, near the summit, at least 200 feet above water level, and is most advantageously situated for economical mine work. In the beginning it was believed, and not without reason, to be the largest hematite deposit ever uncovered in this region; but subsequent work seems to have dissipated that belief to some extent, though the show of ore is large enough to insure hand-

some returns to shareholders, except, possibly, in seasons of unusual business depression. The ore is chiefly a hard blue hematite, with some yellow ochre, averaging well in metallic iron, but too high in phosphorus for Bessemer purposes—is, in fact, what may properly be termed a high grade mill ore. Work is at present being carried on in three cuts—Nos. 1, 2 and 3—though no ore is being mined in the latter two. No. 1 is the most westerly opening, and is near the Dalliba line. Here there is apparently a large body of ore, about 30 feet of which, on the foot-wall side, has been mined out to a depth of, say, 25 feet. At this point the deposit seems to have “slopped over” on the foot-wall side some ten or fifteen feet, as is shown in the present workings, in which the foot-wall is well defined. On the other hand, there is a fine face of ore on the hanging-wall side and the width of the deposit at this point has not yet been determined, though it is certain that there is at least 50 feet of clean ore. A horse of rock is visible in the west face of the pit, but to the east and on the hanging-wall side nothing but clean ore is to be seen. Some idea of the extent of the deposit at this point may be gathered from the fact that a dozen men working day and night shift, are now mining and raising a daily product of 100 tons. When the deposit is fully stripped on the hanging-wall side, and the pit supplied with a skip-road, so that an additional stope can be taken up to the east, it will be an easy matter to double the product of the pit. No. 2 is, perhaps, 300 feet east of No. 1. Here a shaft was sunk 40 feet, the collar being in ore and the lower 30 feet in the foot-wall, from the bottom of which a drift has been driven north across the formation and through 65 feet of clean ore. No. 3 is still further east. Here a shaft is down 30 feet, from the bottom of which the miners are drifting north in mixed ore. It looks as if the deposit might have been shoved over to the north between 2 and 3, and notwithstanding its present bad appearance it is much more than probable that the drift will shortly cut the clean ore; should it not, the plan will be to follow the ore east from No. 2.

A plant of machinery embracing two boilers, two 12x13 engines and four 30-inch interior gear drums, will shortly be added to the mine equipment, though the management is in a quandary as to where the skip-roads, four in number, shall be placed. Ordinarily this would be a question of easy solution; but it so

happens that the branch railway track has been surveyed and located on the hanging wall side, and if the skip-roads are placed on the foot-wall, as they should be, the pits will have to be bridged and all the ore raised trammed across to the other side. The place for the track is, of course, on the foot-wall side; but it is claimed by the railway management that it will be impossible to overcome the grade by the present approach, and the matter thus stands in abeyance. The writer ventures to suggest that the most feasible route for a branch track to the Pascoe would be from the main line at a point near the east end of Lake Michigamme, instead of the loop line at present surveyed and partially built.

Altogether, the outlook for the Pascoe is most promising. The ore body is undoubtedly a very large one, and the ore can, with proper facilities for loading, be mined and put on the cars at a less cost per ton than at any other mine in the district, without exception. The only work done thus far has been the stripping of the deposit and preparing places for the skip-roads, notwithstanding which fact the stock piles contain not much, if any, less than 4,000 tons. With proper machinery in place, it ought to be an easy task to mine and ship 50,000 tons the coming season. The force employed at present numbers about 35, the local management being in the same hands as the Dalliba.

THE NORTHAMPTON MINE

is the property of the Champion Iron Company, and lies immediately west of the Dalliba. The product for 1881 has not been given, having been included with that of the Champion, though the ores of the two are not at all similar in quality or appearance, the Northampton being a hard hematite, lower in metallic iron and higher in silica and phosphorus than the Champion. The workings until lately consisted of the two open cuts described in our last annual review, the east one of which appears to have been abandoned, whether permanently or only for the time being we are not informed. The west pit looks well, and judging from the size and cleanly appearance of the stock pile, is being worked to good advantage. It is an open cut covering an area of about 30x100 feet, worked out to the depth of about 40 feet, with a fine stope of ore standing in the east end, and plenty more of it in the bottom. The ore being of a char-

acter different from that of the Dalliba led to the belief that the deposit did not belong to the same belt, and recent explorations have proved such to be the fact. About 20 rods northwest of the open cut last referred to, a shaft is now being sunk in a deposit of ore 50 feet wide, and of the same quality as that of the Dalliba, with which belt it is probably continuous. Not enough work has been done in this quarter to determine the probable extent of the deposit, but the indications all favor the belief that it is a very large one.

The machinery is the same as last year, the drum formerly used for hoisting from No. 2 pit being applied to the operation of the new shaft.

Just west of this shaft, and in the same section, are the new workings of the

MARINE IRON COMPANY,

which was organized and began operations early in the winter. So far, however, nothing has been done except to strip the drift off a deposit of ore, which appears to be about 80 feet wide, over a length of about 150 feet. The deposit lies at the mouth of a deep ravine, and along the base of the hill to the north of it, and not over a quarter of a mile from the east end of Lake Michigamme. The trend is nearly east and west, and the deposit is undoubtedly continuous with and a part of the new find at the Northampton, the ore being to all appearances the same as that and the Dalliba. A plant of machinery, embracing an engine and two of Merritt's 30-inch interior gear drums is on the ground, skip-roads are being put in, and every preparation made for an active summer's work. Shipping facilities can be secured by building a branch track, not much over a quarter of a mile in length, from the nearest feasible point on the main line of the M., H. & O. R. R. The indications certainly point to the early development of the Marine into a paying mine; indeed, we can see no reason why it should not at once take rank with the Dalliba and Jim Pascoe.

THE ALEXANDER H. DEY MINE,

so-called, because of some most promising discoveries made last summer with the diamond drill, embraces the west half of the north-east quarter of section 3, town 47, range 28. The developments thus far made on this property consist of a series

of three drill holes, the first of which was put down on the west line, through 33 feet of hard red hematite, and 40 feet of hard ore, with 5 feet of quartzite between them. The first of these gave by analysis $66\frac{1}{2}$ and the last $62\frac{1}{2}$ per cent. of metallic iron, both being low in silica and phosphorus. No. 2 hole is about 125 feet east of No. 1, and it is claimed cut 25 feet of limonite—which analyzes from 50 to 60 per cent. metallic iron—and 30 feet of hard red hematite. No. 3, which is 300 feet east of the line, cut alternate layers of clean and mixed ore, and finally 30 feet of red hematite and 8 feet of red specular. These statements are given us by those who had charge of the work, and must be taken *cum grano salis*—no record of the several holes, nor any considerable portion of the cores from them having been kept or preserved. It is just to say, however, that the writer saw some of the cores at the time the drilling was in progress, and does not intend by the foregoing remarks to cast any reflection upon the veracity of those who give the record of the drill holes to the best of their recollection—the fact that no positive record was kept may be ascribed solely to the inexperience of those in charge of the explorations. However, we believe a mistake has been made, and that instead of boring across the formation from the hanging-wall side, the drill was started in the foot-wall on such an angle as to finally carry it through into the hanging, and consequently that the ore body may not be nearly so large as the borings would otherwise seem to indicate. We are led to this belief by the fact that the dip of the Boston, some two miles west, is to the south, under the quartzite, while the holes at the Dey have been bored on the theory that the dip is the other way. At the Boston the red hematite underlies the red specular, and it is hardly possible that their positions have been reversed by what is called a “turn over” in the formation at the Dey. It is the opinion of the writer that the diamond drill can be used to great advantage on this property, before any further effort is made in sinking the shaft now down in quicksand to within 20 or 25 feet of the ledge. This is a timber shaft, the completion of which is made impossible by the enormous pressure of the quicksand; it is, or was, the intention to sink an iron caisson inside the cribbing, but it is our opinion that almost any well-posted miner to whom the matter may be referred will advise against such a course, at least until a better knowledge of the ore measure is had through further use of

the diamond drill. It is more than probable that a paying mine may be developed, but the management will make a mistake if it fails to employ the very best mining skill and ability in the prosecution of the work.

THE DEXTER,

which can not yet be called a mine, lies directly west of the Dey, and embraces the east half of the north-west quarter of section 3, town 47, range 28. As yet nothing of value has been found on the property, if we except the ore cut by the diamond drill immediately on the east line, of which mention is made in our reference to the Dey. The company is now sinking a shaft at a point about 125 feet west of the union drill hole. This shaft is going down on an angle of 45 degrees to the north, in quartzite, the intention being to carry it down 160 feet, and then drift from the bottom, through the hanging-wall, to the ore. This plan has been adopted, we are told, in order to avoid the water and quicksand, but it would seem that some less expensive way of reaching the ore might have been devised. However, the management is supposed to know what it is doing, and it may be that in the long run the plan adopted will prove the most economical, though we take the liberty of doubting it. The Boston vein is believed to lie about 300 feet north, where considerable drift ore, of the variety known as slate, is found, but as yet the ledge has not been reached. This property will be further explored with the diamond drill, as indeed it should be before any considerable further expense is incurred in sinking for ore the position or extent of which is not positively known.

THE ST. LAWRENCE

is a new mine, located in section 5, town 47, range 27, and which is now in course of development by the St. Lawrence Iron Co., in which J. R. Wood, Esq., is the moving spirit. The leasehold covers a tract of 80 acres, the fee of which is, we believe, in the Lake Superior Iron Company. The ore is a rather lean hematite, but one which, it is believed, will work well in the furnace and command a ready sale. Work was commenced by stripping the drift off from what appeared to be a very large body of this ore, but in sinking 50 feet a horse of rock was encountered, and it was thought advisable to cross-cut and test the extent of the deposit before going further. Ac-

cordingly a drift was driven south 22 feet in ore to what is believed to be the hanging-wall, and another 50 feet north in quartzite, with occasional seams of ore, some of the latter being 3 feet thick. There should be ore beyond this quartzite, which, by rights, ought to form the hanging-wall of the main ore body, the greenstone being some distance further north, and the dip of the formation to the south. A drift east from the bottom of the shaft is 22 feet in ore, which seems to be making around the horse of rock referred to, showing that the deposit widens out in that direction, while another west is 10 feet in ore. These shafts and drifts having satisfied the management that the deposit is one of goodly proportions, though possibly not as large as first believed, a plant of machinery, consisting of a double engine and two 5-foot Lane drums, has been ordered, and every preparation is being made for the commencement of actual mine work.

The mine can be supplied with shipping facilities by a one mile extension of the Excelsior branch of the C. & N. W. Ry, which is promised to the management in ample time to enable it to ship all the ore that can be mined before the close of navigation next fall.

THE MESNARD MINE,

a new property in the first stages of development, is the property of the Mesnard Iron Company, and embraces the north-west quarter of the north-west quarter of section 28, town 48, range 29, which is held under a lease from the Atlantic Iron Company. The company, the stock of which was taken by individual shareholders of the Atlantic Iron Company, starts out with a working capital of \$20,000 in its treasury, and is now opening up what appears to be a very large deposit of hard hematite similar to that of the Jim Pascoe. The shares are subject to additional assessments not exceeding \$1.50 in all, but it is believed the amount already called in will be amply sufficient to place the mine in good condition to take care of itself and return at least a portion of the original assessment to the shareholders. The developments so far consist of a number of pits, two of which are near the west line, with a drift of 35 feet between them, pits and drift being all in clean ore. About 150 feet further east there are two more pits showing about the same width of clean ore, while 500 feet further along there is a

shaft down 50 feet from which, at last accounts, drifts were in progress both ways, and nothing but clean ore to be seen.

The officers of the company are:

President—A. M. BYERS;

Vice President—W. H. MCCURDY;

Sec. & Treas.—J. H. OUTHWAITE.

The Union Iron and Steel Company, of Chicago, has been exploring with a diamond drill on the west half of the north-west quarter of section 3, and the north-east quarter of section 4, town 48, range 27, for a year past, but without satisfactory results. Their explorations are now being conducted under the general supervision of Geo. A. St. Clair, and if there is any merchantable ore on the tract he will certainly find it.

Mr. Alfred Kidder is sinking and drifting on the east half of the north-east quarter of section 29, town 48, range 29, of which he has a lease from the Atlantic Iron Company, and where he has half a dozen pits down in what the miners call a "hard steel ore," of excellent quality, and which most people would denominate a red specular. The indications are that this will prove one of the most valuable properties on the north range.

SAGINAW RANGE.

THE WINTHROP MINE,

which at the date of our last annual report was believed to be in good condition for a large and profitable production, met with a disaster last fall which, if it has not since wholly absorbed the profits earned during the year, has been at least a most serious and expensive set-back. It will be remembered that the workings consisted of one large open pit, which had been worked out to a depth of 190 feet on the second and third levels, while mine work was being prosecuted on the fourth or 220-foot-level—and what was called the west end pit, which was being wrought on the underground plan. This last was believed to be perfectly secure, because of the pillars which had been left, and the large amount of timber which had been put in to sup-

port the roof and walls, but during the heavy rains last fall the supports gave way and the whole west end of the mine fell in, filling the open pit with not less than 150,000 tons of rock, completely destroying the skip-roads and burying the pumps. Since then five skip-roads have been constantly employed in hoisting out this rock, of which, together with the crushed pillars of ore and broken timbers, at least 50,000 tons remain to be hoisted. But for the ore which fell with the rock, of which there must have been a considerable body in addition to the fallen pillars, the better way would have been to abandon these workings altogether, and attack the deposit underground from some other direction, as indeed the management has determined to do by sinking a deep shaft, 13x17 feet inside the cribbing, at a point about 300 feet north-west of the open pit, in the meantime continuing operations in the old workings just so far as they can be carried on with safety. This deep shaft, the sinking of which and a renewal of the lease to the Winthrop Hematite company, the members of which hold a controlling interest in the fee, has led to litigation which is not likely to result in good to any of the parties in interest—but of this it is not our province to speak at present. The plan is to sink this shaft to a depth of 400 feet, perpendicularly, where it is estimated it will cut the ore, which dips to the north, the outcrop being, perhaps, 200 feet south, the trend of the formation being nearly east and west. From this shaft headings will be driven south to and through the ore to the foot-wall of the deposit. From these headings, or tunnels, drifts will be made east and west the whole length of the ore body, and the deposit then roomed out in chambers, by which means it is believed that two-thirds of the ore can be safely mined out. The first of these headings can be started from a point 200 feet below the collar of the shaft, and through it all the ore west of and above the present level of the old openings can be reached; the next one lower down, will carry this system of underground work under the bottom of the old workings, and enable the management to prosecute mining operations along the whole present known length and width of the deposit. Indeed in this way work can be prosecuted on two or more levels at once, while the shaft, in the meantime, is sinking to others. The plan is a comprehensive one, and the only wonder is that it should not have been adopted long ago. When fully inaugurated, should the deposit

hold its own to the depth anticipated, the lessees will find no difficulty whatever in mining and raising to the surface the 40,000 tons upon which they have bound themselves to pay royalty—indeed, we see no reason why the annual product should not be doubled as compared with the largest yield in any one year heretofore. The shaft is now down 170 feet, and we shall not be surprised if the proposed heading on the 200-foot level reaches the ore before the close of the coming season.

What is known as No. 7 is about 300 feet south-west of the deep shaft. Here a shaft is down about 130 feet, from the bottom of which ore of a quality about evenly balanced between first and second class is being hoisted to the surface. The vein or lens at this point is not very thick, while the ground eastward to the old open pit is practically unexplored—the fair inference being, however, that a very large body of ore lies between.

The annual product of the Winthrop during the past twelve years has been as follows:

	<i>Gross Tons.</i>
1870.....	3,469
1871.....	11,088
1872.....	14,239
1873.....	33,456
1874.....	7,549
1875.....	7,502
1876.....	27,236
1877.....	12,549
1878.....	23,740
1879.....	26,595
1880.....	45,247
1881.....	43,630
Total.....	256,300

Altogether, we see no reason to modify the opinion heretofore expressed that the Winthrop is one of the very best hematite properties in the region. Notwithstanding the great disaster referred to, shipments commenced this season from stockpiles aggregating not less than 10,000 tons, and as much more can, we think, be taken out with the removal of the debris from the bottom, from which last enough more ought to be secured to insure a comfortable product this year, though, of course, it is not expected that the output of last year can be reached.

The mine affords employment to about 150 men. No new machinery has been added during the past year.

THE MITCHELL MINE

is in excellent condition, and promises a largely increased product this year, the management having sold 33,000 tons for delivery the present season of navigation. No. 2 shaft is now down 120 feet in ore. From its bottom the miners have stoped and drifted 430 feet east, all the way in ore, though as yet the deposit has been cross-cut in only one place, where the ore body was found to be 81 feet wide. This lens extends west of No. 2 shaft to within 30 feet of No. 1 shaft, 320 feet, from which it will be seen that there is here a continuous run of ore, so far as developed, 750 feet in length. No. 1 shaft is located in a rock crossing, to the west of which there is another seemingly large lens of ore which is reached by drifting a distance of about 40 feet from the shaft; similar drifts, 30 feet in length, connect No. 1 shaft with the workings east of it. The ore body is attacked by running a heading as far back from the shaft as it is considered advantageous to tram the ore, and from this drift or heading the ore is mined out in chambers, the size of which is governed by the character of the ground, though they are generally 15 feet high, a roof well supported with timbers and pillars being left on each level. Mine work is thus being prosecuted on three levels, and we can see no reason why the management should not be able to raise a much larger product than is indicated by the amount of ore sold for this year's delivery. It is certainly one of the most valuable mines of its class in this region, with, in addition to its present developed value, still larger possibilities for the future. No effort has been made to develop the apparently large and distinct lens which was spoken of in our last annual review as having been found by drifting south through 93 feet of soapstone, and the writer still holds to the belief that the present workings at the Mitchell are but an indication of the greater developments yet to be made.

Since the commencement of operations at the Mitchell her annual product has been as follows;

	<i>Gross Tons.</i>
1872.....	197
1873.....	8,658
1874.....	7,549
1876.....	5,596
1877.....	3,989
1878.....	4,259
1879.....	11,131
1880.....	13,297
1881.....	21,146
Total.....	75,731

The mine gives employment to about 90 men, and is under the general management of Capt. Sam. Mitchell, with Thomas Walters in charge of the mine work. No new machinery has been added the past year.

THE NATIONAL

experienced a heavy fall of rock some time ago which filled No. 5 pit with debris, and put a most effectual stop to mining operations in that quarter. The pit is being re-opened by sinking a shaft through the arch at the west end, from which the miners will work under the old bottom, leaving a solid roof to support the walls and protect the mine against further accident. At No. 2 they are working in a newly discovered lens which is from 6 to 15 feet thick, and between 300 and 400 feet long. This was found by breaking through the fault or rock crossing at the south end of the old pit. Though not fairly opened, they are now raising about 1,500 tons a month from this new pit, a product which can be gradually increased as the work progresses. At No. 1 the foot-wall came in very rapidly, and either cut the ore out altogether, or else shoved it over into the hanging—a question which will soon be determined with the aid of a Sullivan diamond drill, which is now at work. It is the intention to most thoroughly explore the whole tract by a series of borings which will test every foot of ground where there is the least probability of finding ore.

The annual product of the National has been as follows:

	<i>Gross Tons.</i>
1878.....	4,191
1879.....	33,310
1880.....	29,351
1881.....	24,833
Total.....	91,685

Owing to the fall of rock in No. 5, and the unexpected fault or break in the formation at No. 1, the output the present year will not be as large as otherwise might have been expected, though the management counts on a slight increase over 1881, placing its estimate at not less than 25,000 tons. The machinery is the same as last year, with the exception of a new boiler. Capt. Sam. Mitchell is general manager, and Joel Williams mining captain. The mining force numbers about 100 men.

THE SAGINAW MINE

still lives, though all the old original workings have been abandoned, with the exception of No. 2, which is now being wrought on the 540-foot level, where there is from 6 to 10 feet of ore remaining in the bottom. This pit, too, shows signs of exhaustion, and it is probable that another season's work will finish it. Scrammers are at work in some of the other pits, but these are considered by the management as practically exhausted, a thorough exploration with the diamond drill, by which the foot and hanging walls were perforated in every direction, having shown nothing but barren ground. The same state of affairs exists at the old section 19 workings, leased by the Saginaw from the Lake Superior Iron company, where only a few scrammers are at work cleaning off the walls. The vein in these workings has pinched out to from 3 to 5 feet of ore, the mining of which will not pay for raising the water.

A recent new discovery on the west half of the north-east quarter of section 20, which is a part of the tract leased from the Lake Superior Iron company, promises to compensate the company, in part at least, for the loss of the old workings. This discovery was made with the diamond drill on the east line of the tract mentioned, and not far from the old original hard ore pits of the mine once known as the New England. The first hole, 340 feet east of the line, penetrated 25 feet of very fine slate ore, so soft that the action of the drill reduced it to a powder, only a few small pieces of core being secured. These, together with analyses of the sludge, show the ore to be of a very superior quality in all respects. A second hole was drilled at a point 140 feet further west, and shows 12 feet of the same kind of ore; another, 100 feet east of the first, cut $9\frac{1}{2}$ feet of ore. A working shaft is now well on its way down to the ore, which it will reach at a depth of about 85 feet, and from which

it is intended to attack the lens on the underground plan. The borings show a lens varying from $9\frac{1}{2}$ to 25 feet in width, and at the very least 240 feet long, though it is by no means certain that further drilling will not show a much greater length. It is certainly a most promising show, and one that is likely to develop into a mine of more than ordinary proportions.

The Saginaw has produced as follows, annually:

	<i>Gross Tons.</i>
1872.....	18,508
1873.....	37,138
1874.....	45,486
1875.....	55,318
1876.....	56,979
1877.....	44,005
1878.....	54,097
1879.....	43,396
1880.....	35,059
1881.....	30,793
Total.....	420,774

The mine gives employment to about 100 men. Capt. Sam. Mitchell is general agent and superintendent, with skilled mining captains in charge of the day and night shifts. The machinery is the same as last year, only a part of which, however, is now required to do the work.

THE GOODRICH MINE

presents some new and better features this year, and the indications are that it will not much longer be regarded as a small mine with nothing but a low grade ore to offer to consumers. A new shaft, 230 feet west of No. 2, is down 80 feet, and in very clean looking slate ore, entirely different from the "bird's eye" found in the more easterly workings. This slate ore will, we think, pass muster as strictly first-class, though we have not been favored with an analysis from which to draw such a conclusion. A drift connects this new shaft with No. 2, running through the 20 feet of soapstone at the west end of the old workings, and thence through bird's eye ore to within 3 feet of the new (No. 3) shaft, where the slate ore first occurs without even a seam of rock to mark the division. A drift is in progress west from No. 3, in slate ore, but as yet this part of the deposit has not been cross-cut and its exact width is not known, though the size of the shaft, the bottom of which shows nothing but clean ore, proves that it is at least wide enough to insure

a handsome product when fully opened up and energetically wrought.

Since our last annual report the numbers of the shafts, or skip-roads, have been changed, the most easterly now being No. 1. No. 1 is the same depth as at date of last review, 160 feet. In this pit there is a stope 40 feet high and 100 feet long, working east, the vein averaging 25 feet in thickness. West of No. 2 skip-road a winze is down 50 feet, to the lowest level, and drifting is in progress to connect it with the shaft. This will give two large stopes, one east and one west of the rock-crossing, while there are still two others working east from the shaft, making five stopes in all, not taking No. 3 shaft into the account. There is, in fact, a run of ore, broken only by the soap-stone crossing at the west end of No. 2, 400 feet in length, and still continuing east and west. That the mine has not achieved a larger product in the past years is due to the fact that the ore, though not strictly first-class, is yet better than second-class, and there has consequently been a continual hitch between the owner and consumers as to the price at which it should be sold—the former declining to sell it as second-class, and the latter generally refusing to pay more. Could the owner and consumer agree in this particular, it would be an easy matter to raise from 25,000 to 30,000 tons annually from the present workings; but Mr. Goodrich is firm in the belief that the ore won't spoil for the want of mining, and consequently insists on raising no more than he can sell at prices satisfactory to himself. However, it is more than probable that the new find will result in an enlarged product hereafter, from the fact that it will, besides adding to the output, help to sell the leaner ore referred to, and which, so far as we can learn, has given good satisfaction to consumers. Indeed, the bird's eye ore of the old workings has very materially improved in quality in sinking, and, if it continues to do so for one or two more levels, will become a distinctively first-class ore.

The annual yield of the Goodrich has been as follows:

	<i>Gross Tons.</i>
1873.....	3,258
1874.....	1,300
1875.....	1,780
1877.....	503
1878.....	7,547
1879.....	3,992
1880.....	11,181
1881.....	10,245
Total.....	41,606

If the owner will not take it amiss, the writer would like to suggest that nowhere in this whole region is there a more profitable field for the employment of one of Bullock's diamond drills than right here on the Goodrich tract. The character of the ore under the old workings can thus be ascertained at a comparatively trifling cost, while the writer feels confident a few well placed holes west and south-west of No. 3 shaft will reveal a body of rich slate ore, the development of which will give the Goodrich a place among the first-class mines of the district. The finding of the slate ore in No. 3 shaft is no surprise to us; we knew of its existence still further around the end of the hill in the north face of which the present workings are situated, as long ago as 1872, and the files of our paper will show that we have never criticised the management except to deplore the expenditure of money in the development of a lean ore body, instead of looking for and opening up the richer deposit, the existence of which was well known to others than ourself. To accurately locate that deposit, now that an opening has been made in its east end, a diamond drill is indispensable, if speedy and economical development be the desire of the owner. Captain Davis is a practical miner of long experience, and if given half a chance will demonstrate the faith that is in him by converting the Goodrich from a mining eyesore into one of the most valuable of its owner's possessions.

The mine numbers about 45 men on its pay roll. The machinery is the same as last year, with the exception of a new 3-foot Lane drum, recently added.

THE CASCADE RANGE

Lies some four miles south from the city of Negaunee, and takes its name from that of the stream which makes its way in a succession of beautiful cascades through a gorge in the moun-

tain range in which the ore formation is found, and near the point where the first openings were made under the auspices of Waterman Palmer, Esq., in 1864. In that year some four or five hundred tons of lean ore were mined, but organized effort for the development of the range was not made until the organization of the Cascade Iron Co., which succeeded to the ownership of the Palmer tract in 1870, and began mining operations on an extensive scale the following year. A branch line of the C. & N. W. R'y was secured and the first shipments made in the fall of 1871, the Cascade company continuing operations until the fall of 1874, when it was forced into bankruptcy, and M. F. Saulsbury, Wm. Bagaley and Joseph Kirkpatrick came into possession, as agents for the bondholders. Under the very able and efficient management of Mr. Kirkpatrick, the old Cascade has been made to pay all its indebtedness, not only, but has likewise absorbed the lands of the Pittsburgh & Lake Superior Mining Co. through the purchase of all the stock of that corporation, and its re-organization with Ralph Bagaley, Esq., of Pittsburgh, as president, and Mr. Kirkpatrick general agent and manager. What was once the Cascade mine, more recently the Palmer, therefore, now includes what was formerly the Watson, and Pittsburgh & Lake Superior mines. The whole constituting an estate of 26,450 acres, is now called the

PITTSBURGH & LAKE SUPERIOR.

The shipments from the mines of this company since the beginning of operations have been as follows:

	<i>Gross Tons.</i>
1871.....	4,171
1872.....	40,655
1873.....	50,418
1874.....	19,560
1875.....	4,071
1876.....	15,324
1877.....	20,211
1878.....	5,929
1879.....	24,633
1880.....	28,881
1881.....	39,276
Total.....	263,129

The above table includes the shipments made by the Pittsburgh & Lake Superior under the old regime and which have heretofore been reported separately.

The operations of the company are still confined to the

openings heretofore referred to as the West End Palmer, and from which all the ore mined since 1875 has been raised, with the exception of, perhaps, 2,500 tons mined at the old Pittsburgh & Lake Superior pits. At the west end mine, which was fully described in our last annual review, some changes for the better are observable, especially in No. 1 pit, where there are now two distinct and separate lenses of ore, the old one, on the foot-wall side, carrying an average width of about 22 feet, and being 180 feet in length. Over this lens there lies about 20 feet of jasper, in cutting through which last spring a lens of granular ore 16 feet thick was discovered; this lens has since been opened up over a length of 68 feet from a point where the rock cuts it off at the north end, but is believed to extend thirty feet further south to a connection with the deposit on the foot-wall. From this one pit the major part of last year's product was raised, though the new lens could not, necessarily, be sufficiently developed to be of much use. It is a fair presumption, however, that it can be made to contribute largely to this year's output, though an enlarged product cannot reasonably be expected, in view of the fact that what has been gained in this pit has been lost in some of the others, especially in No. 2, which has been exhausted and abandoned, though it is believed, and with good reason, that the No. 1 lens makes around the old No. 2 workings on the hanging-wall side. Sinking for stopes to the 340-foot level is now in progress in No. 1, the plan being to sink in the foot-wall lens, and drift through the 20 feet of jasper into the ore on the hanging-wall side. Aside from the expense of cutting through it on each succeeding level, the jasper division is an advantage rather than an obstacle to economical mine work in this pit, since a large part of it can be left in lieu of the ore pillars which would otherwise be necessary to support the walls. The ore on the foot-wall side is of a slaty structure, while that of the other lens is a very fine granular, both first-class in every respect save as to phosphorus, in which particular they are gradually improving.

As stated the ore in No. 2, in which at the time our last review was made there was 6 feet of lean ore, has been abandoned for the present, but we venture the opinion that a cross-cut into the hanging will intersect an extension of No. 1 lens, the ore bearing formation at this point being at least 100 feet wide.

In No. 3 the 16-foot lens in which the miners were at work last year has pinched out to 6 feet, but has been found continuous with the deposit in No. 4, while a cross-cut through 24 feet of soapstone on the 260-foot level, cut a lens of ore 6 feet thick, and, so far as known, 30 feet long. In No. 4 there are two veins or lenses, one of 3 feet on the foot-wall, and one of 6 feet in the hanging, with 16 feet of rock between. The skip-road is down to the 300-foot level, but mining in this pit scarcely pays expenses, owing to the fact that a large amount of the rock which separates the lenses must necessarily be taken down and hoisted out.

It will be remembered that the formation, the trend of which is nearly north and south through Nos. 1, 2 and 3, swings around to the east at No. 4. About 800 feet east of the last named pit, the diamond drill cut 7 feet of clean ore, but the intervening ground has not yet been explored. It is more than probable that the ore cut by the drill is an extension of the No. 4 deposit, though it looks to us as if there were here simply a succession of detached lenses of variable size, the formation being very irregular, broken and unsettled. Let this be as it may, it is certain that no settled ground of the kind in which it is generally expected to find ore bodies of a durable character has yet been reached; but, if our theory is correct, the presence of these lenses is a sure indication that larger and more regular ore bodies will certainly be found at a greater depth. In either event, there is promise of enough ore to insure a long life to the mine. Sinking is in progress in the newly discovered deposit last referred to, the outcrop of which has been found, it being the intention to go down 30 feet and then drift and open an underground pit. Three-quarters of a mile further east, near the company's barn, and a short distance north of the hill in which were located the old Cascade workings, the diamond drill passed through 17 feet of first-class ore, boring perpendicularly, while another, started from the hill 200 feet south, struck what is believed to be the same lens much nearer the surface, where there is only 4 feet of ore. These borings, aside from the evidence they furnish of a probably continuous run of ore nearly, if not quite, one mile in length on the company's lands, seem to indicate that the lenses or vein may be expected to increase in size "as they go down," and most certainly justify the belief that the Pittsburgh & Lake

Superior may be made one among the most productive mines of the district.

The mine gives employment to about 165 men, all told, all of whom are under the direct command of Capt. Whitesides, the most industrious and careful of mining superintendents. The stock piles show an accumulation of about 15,000 tons of very clean looking ore, and the year's product will about equal that of 1881. No new machinery has been added during the past year, if we except a new 4x16 boiler and one of Bullock's diamond drills, with which last it is intended to explore every rod of ground between the west end and the "location" during the present summer. A new steam saw-mill has been set up near the site of the old one, and, together with a shingle mill, lath machine and planer, will be in full operation by the time this review goes to press. Altogether the Pittsburgh & Lake Superior, thanks to the admirable management of Mr. Kirkpatrick, is in the most gratifying and prosperous condition—a condition which gives assurance of long and profitable future production.

THE WHEAT MINE

adjoins the Pittsburgh & Lake Superior on the east. Concerning this mine there is very little that can be said, the past year's operations having made but little change in its general appearance. At the new find, in the east end, the appearances, judging from what is to be seen in the open pit, are all indicative of the existence of a very large body of ore extending north-easterly through the hill and into the swamp beyond it, though a diamond drill hole, bored from a point just west of the shipping dock, cut only 5 feet of ore lying at a depth of 260 feet from the surface. This boring, however, being just at the turn in the formation, is rather favorable than otherwise, having apparently either cut the ore on the dip from No. 5, or else the west end of the lens in which the open pit is located, and which on the surface certainly gains much in width going north-east. We venture the guess that the further employment of a diamond drill at points east and north-east will verify the prediction here made that the main ore body, and one of goodly size, will be found not far off in that direction. In No. 5 there is very little of an encouraging character to be seen. The ore, of which there may be four or five feet one

day, pinches out the next, comes in again and then pinches out once more with the most distressing regularity—there being just enough of it to encourage the management in its effort to find more. Some work is being done south of the Cascade branch railway, where there is a body of good looking hematite which can be wrought to advantage with the necessary machinery. If the management were to ask our advice (something it is not likely to do, we hope,) we should suggest a systematic exploration east and north-east of the open pit as the most likely to result in the material enlargement of the mine. An enlarged product cannot be hoped for unless new openings are made, and if there are any considerable bodies of ore on the property, in addition to the one now being wrought, they can only be looked for in the direction we have indicated. However, there is no good reason why a product as large, if not larger, than that of last year should not be achieved the present season. The stock-pile contains about 2,000 tons, mined during the winter without further effort than that incidental to the work of preparing the mine for an active summer's campaign. A new skip-road has been placed in the open pit, and other facilities added for the economical working of the mine, the yield of which will probably be about the same this year as last, the annual product heretofore having been as follows:

	<i>Gross Tons.</i>
1873.....	1,091
1874.....	2,139
1879.....	851
1880.....	3,323
1881.....	9,040
Total.....	16,444

Capt. Prout, a miner of long experience at the Jackson mine, is now in charge as mining superintendent, and will make the Wheat give a good account of herself in the near future.

THE GRAND RAPIDS

mine, if such it can yet be called, embraces the south-west quarter of the south-east quarter of section 28, town 47, range 26, and is a part of the Gribben tract, upon which some work was done, and 3,599 tons of second-class ore mined in 1872. The 40 acres described above were leased by the Grand Rapids Iron Company sometime last summer, since when explorations have been carried on with some promise of good results, though we think

the work now being done is a waste of money, that might, to say the least, be expended to better advantage. The work referred to consists in carrying a cut into a body of silicious ore, which, at best, can only be rated as second-class, if, indeed, it can be sold at all. We believe good ore—as good as that of the Wheat—exists on the property, but it certainly has not yet been found, nor is it likely to be except with the aid of a diamond drill, or the expenditure of a large amount of money which might be saved. There is, it is true, some good ore in the deposit now being opened, but apparently not enough of it to pay for mining, while on the other hand a deposit of hard hematite of good quality near the east line is scarcely receiving the attention it merits. We hope we may be mistaken, but it does not look to us as if there were much prospect for the development of a paying mine at the Grand Rapids in the very near future. There is, however, every reason to anticipate such a consummation when the management comes to realize the fact that skill and experience are as requisite in the finding of a new mine as they are indispensable to its subsequent development.

The officers of the Grand Rapids Iron Company are:

President—I. J. WHITFIELD;

Secretary—MARCUS W. BATES;

Treasurer—ISAAC PHELPS.

Immediately east of the Grand Rapids is the

LAXEY MINE

which is owned in leasehold by a company of that name, recently organized, and the officers of which are as follows:

President—J. Q. ADAMS;

Sec. & Treas.—P. B. KIRKWOOD;

Gen'l Manager—H. M. ATKINSON.

This company has a really fine show of hematite in a shaft which is down 70 feet, and from the bottom of which a drift has been driven 30 feet, all the way in ore, but not, we apprehend, exactly at right angles with the trend of the formation. The ore is, apparently, of the very best quality, an analysis made by Judson, of Cleveland, showing 64.70 per cent. metallic iron, and only .023 of phosphorus. The only question as to the value of this find is as to the extent of the deposit, and that will be settled by sinking the shaft 30 feet deeper, and then drifting in all directions. A small plant of machinery, con-

sisting of an engine and two drums, does the work of hoisting. The writer will miss his guess if the Laxey does not finally respond to the most sanguine anticipations of its owners.

THE CLANCY IRON COMPANY,

recently organized in Grand Rapids, has a force of men exploring on section 28, 47—26, just north of the Grand Rapids tract, but thus far has found nothing of value. The management is confident of finding the Wheat vein, the present trend of which is in that direction. The officers of the Clancy are:

President—JOHN CLANCY;

Secretary—M. W. BATES;

Treasurer—I. M. WATSON.

THE MEXICAN IRON COMPANY,

organized some time during the past winter, holds a lease, with an option for the purchase, of the old Carr mine, which embraces the north-west quarter of the north-east quarter of section 33, town 47, range 26. Some exploration work has been done during the past winter, and, it is claimed, a promising deposit of hard hematite found, but our information is only hearsay. No work is being done at present, and consequently we have not thought it worth while to visit the location—though for aught we know to the contrary, the Mexican may be as promising a property as any of its immediate neighbors. Some work was done at this location, and 2,380 tons of second-class ore mined and shipped in 1872. The officers of this new company are:

President—W. F. SWIFT;

Sec. and Treas.—GEO. W. HAYDEN;

Superintendent—GEO. BERRINGER.

Some explorations are being made on section 32, by Mr. Judd and others, of Cleveland, Ohio, where, we learn, hematite of good quality has been found, with excellent promise for enough of it to insure a paying mine.

THE CHESHIRE MINE

has been practically idle the past year, and remains in about the

same condition as at the time of our last annual review. The annual product has been as follows:

	<i>Gross Tons.</i>
1872.....	13,445
1873.....	9,328
1875.....	187
1876.....	225
1877.....	8,434
1878.....	16,924
1879.....	17,985
1880.....	13,202
1881.....	7,449
Total.....	87,179

There being nothing new to report in connection with this mine, it is scarcely necessary to repeat what has already been written concerning it. We understand, however, that mining operations will be renewed at once, to which end the pits which have not been permanently abandoned are now being unwatered. It should be mentioned, likewise, that a shaft is being sunk some distance north of the old workings, and near the Swanzey line, which is in black slate. It is highly probable that the ore body will be found extending in this direction to a connection with the

SWANZEY,

which is certainly a most promising property, as a merely casual inspection of the workings cannot fail to convince the visitor, even though he be a novice in mining affairs. This is a leasehold, which covers the south-west quarter of the north-east quarter of section 18, town 45, range 25, and of which J. J. Pierce and others are the lessees. It is given out that a corporation to be called the Swanzey Iron Company will shortly be organized with the sole view to the more convenient handling of the mine and its business affairs.

The Swanzey workings are located about one-third of a mile north-west of the Cheshire, the trend of the formation being from north-west to south-east, and the dip about 60 degrees to the north-east. The workings consist of one large open pit, which has been worked out over a length of 200 feet and to a depth of 40 feet, the bottom, which is all in ore, being 67 feet wide at the widest part. At the south-east end of this pit the

ore narrows down considerably, but this is evidently due to the fact that the pitch in that direction carries it under a capping of rock, while at the north-west end the same peculiarity is noticeable, a wedge of rock coming in and apparently dividing the ore which makes around it on both sides. This may, however, be simply a horse of rock, beyond which the ore may again unite into a solid body, the pitch at this point having seemingly changed to the north-west; this theory is not, however, corroborated by the developments thus far made to the north-west, where a shaft, 90 feet from the point where the split in the deposit occurs, is down 70 feet, from the bottom of which a drift 8 feet south-east shows nothing but mixed ore, though a similar drift in the same direction, starting from a point 12 feet higher up in the shaft, cut 10 feet of ore after passing through 10 feet of rock. The ore in this drift is, nevertheless, somewhat mixed—at all events not strictly first-class. It is very probable that further explorations in this quarter may be productive of more satisfactory results, since it is by no means certain that either branch of the main deposit to be seen in the open pit has been cut, or that the shaft itself is deep enough to strike the ore, if, as we believe, the pitch carries it under the wedge of rock at the north-west end.

The ore body, as shown in the open pit, will average 50 feet in width, all seemingly clean ore. It is enclosed between walls of chloritic slate, which forms the hanging, and a lean ore and jasper on the foot-wall side. A shaft, located about 50 feet from the north-west end of this open pit, and 10 feet from the hanging, is down 46 feet in the bottom, all the way in ore, as is also a drift 50 feet to the south-east, except that the first 15 feet shows mixed ore and rock on the foot-wall side. This shaft and drift, allowing the dip to be unchanged, show at least 40 feet of ore on that level, and it is safe to assert that there is now at least 50,000 tons of ore in sight in this one pit, the most of which, if wanted, can be mined out the present year. The ore in the south-east half of the pit is a very hard, rich red specular, of a bluish color, while the balance is somewhat broken, and more or less mixed with limonite. Mr. Wright, by permission, has favored us with an average analysis of samples taken by himself from all parts of the bottom of this open pit, which showed as follows:

Oxide of iron.....	95.28
Alumina.....	1.35
Lime.....	.60
Magnesia.....	.35
Sulphur.....	.02
Phosphoric acid.....	.31
Silica.....	2.06

Metallic iron..... 66.70

Phosphorus..... .135

It will thus be seen that while the ore is too high in phosphorus for Bessemer purposes, it is yet a high grade mill ore, first-class in every other particular.

The mine is supplied with a double side track from the Cheshire branch, which extends some four or five hundred feet past the pockets, under which one of the tracks passes, the other being on the outside; by this means the very greatest facility in the handling of the ore after it is brought to the surface has been secured. This double side track is on the hanging-wall side of the mine, from which last a trestle-work 250 feet long and 25 feet high supports the tramway on which the ore is trammed to the pockets. The hoisting is at present being done in buckets, the machinery consisting of a Rochester engine with a single 4½-foot drum and two derricks. The miners are sinking and stoping at the upper end of the pit, and the superintendent assures us that when the new plant of machinery which has been ordered is in place he will be able to meet all the demands the owners may make upon him for ore the present season, within a limit of 40,000 tons—and the writer does not consider him by any means extravagant in his estimate of the productive capacity of the mine.

THE WEST REPUBLIC MINE

closed the first year of her existence with an output of 7,354 gross tons of as pure ore as was ever mined in the district. The writer was not far wrong in his estimate a year ago, as will be seen by reference to his last annual review, in which, by the way, in nearly every instance, his estimates as to production fell below rather than exceeded the actual figures shown at the close of the season.

The West Republic is the property of a corporation of the same name, in which the St. Clair brothers are the principal shareholders, and under whose direct management and control, as officers, the mine was opened and is now being wrought.

The property embraces lots 4 and 6, in section 7, and lots 2, 7 and 8 in section 18, town 47, range 29, the tract lying in a compact body, and on both sides the Michigamme river at the point where it leaves Smith's bay. One-third of the fee is owned by the St. Clair brothers, and the other two-thirds by the Toledo Iron, Lumber and Water Power Company. Work was commenced in November, 1880, at a point about one-quarter of a mile north-west of the Perkins pit of the Republic mine, where a shaft was at first put down through 27 feet of drift and 40 feet into ore mixed with jasper. This shaft is called No. 1, and through it very nearly all the ore thus far mined has been raised to the surface. From the bottom of this shaft, on the first level, a drift was run north-west some distance in a narrow run of clean ore to what appears to be the main lens, and which on this level is at least 80 feet long, and 30 feet wide on the average, the trend of the formation being from south-east to north-west, the dip 50 degrees north-east, and the pitch to the west. The floor of this chamber is all clean ore, and the ore appears to be making more rapidly under the hanging, while the foot continues nearly vertical, so that the lens seems to be gaining considerable in width, as it will undoubtedly increase in length in proportion as it pitches under the rock-capping to the west. Near the west end of this chamber a drift south-west connects with what is called the south lens, in which there is 20 feet of ore, only 12 feet of which, however, is clean and first-class. The dip of this lens is flatter to the north-east than the other, and the indications are that the two come together at no very considerable depth below the bottom of the shafts.

One hundred and sixty-four feet west of No. 1 shaft known as No. 2 is down 135 feet. This shaft is in the south lens, and is connected with the other, on the second level, by a drift and winze, the intention being to make it the main hoisting shaft. With this end in view a shaft house has been erected, from the top of which a tramway will connect with large pockets over the railway track, and the stock pile beyond; a skip-road is being put in, and the skips will shortly be in operation hoisting ore from the second level, on which the stopes are now ready for the drill and blast. So far the hoisting has all been done in buckets, and principally through No. 1 shaft, which is now down 106 feet, with a drift into the main body in the north lens.

The diamond drill which has been at work exploring the ground eastward to the Republic line has not as yet found anything of much value, but is still kept going in the belief that good results will ultimately be attained in that direction. It is proper to say, however, that No. 1 shaft appears to be in the east end of the lens of ore described, notwithstanding the fact that the drill has cut a few feet of ore to the eastward. It looks to the writer as if the heaviest part of the ore body might be found west of the present working, under and across the river, though it is not unreasonable to anticipate the existence of one or more lenses east of No. 1.

About 10,000 tons of very fine ore was mined during the winter, and it is safe to predict a product of from 20,000 to 25,000 tons the present year. The machinery is the same as last year; the mine gives employment to about 80 men, and Capt. George Mitchell remains in charge as mining captain.

THE ERIE MINE

is located on the north-east quarter of the north-west quarter of section 28, town 47, range 30—about four miles north-west of the Republic, on the west side of the Michigan river. It was opened in 1875 by Rawle, Noble & Co., together with some Chicago parties, with Capt. Jas. F. Trowell, a novice in mining, as local superintendent, and who mined from an open cut about 3,000 tons of ore, 1,052 tons of which was hauled out to the Kloman and shipped. The vein in which the original work was done appeared to carry a width of about 8 or 9 feet of rather mixed magnetic ore, over which the old workings extended a length of about 50 feet, worked out to a depth of 80 feet. The trend of the deposit is diagonally across the 40-acre tract, from south-east to north-west, and the dip undoubtedly to the north-east, though the management in 1876 would have it the other way, and proceeded on that theory. On the north-east side of the old pit there is a stratum of soap-stone, and on the opposite side what appeared to be a solid wall of mixed quartz and slate ore. This last, strange as it may appear even to a tyro in mining, the original management mistook for a hanging-wall, and in all its operations studiously confined itself to the narrow run of magnetic ore, invariably stopping the stopes and drifts whenever the mixed ore and quartz was encountered. It was a recklessly ignorant waste of money, from

which the owners of new and undeveloped properties can imbibes a valuable lesson—a lesson which should warn them to entrust the work of development in such cases to none but competent and experienced miners. Our friend Trowell is undoubtedly a first-class steamboat captain, but certainly among the very last we should select to steer a new mining enterprise clear of the rocks and shoals of financial disaster—and at the Erie he seems to have as determinedly steered clear of the main body of ore as he would cautiously avoid the shoals and rocks laid down in the lake charts, with which last, it is no reflection to say, he is much better acquainted than with geological formations.

Last summer Mr. E. H. Wright, of Toledo, Ohio, secured a lease of the Erie tract and organized the Erie Iron Company, of which himself, W. A. Wright, Peter Pascoe, Byron H. Andrus and F. H. Kearney are the directors—the officers being:

President and Gen'l Manager—E. H. WRIGHT;

Vice President—PETER PASCOE;

Secretary and Treasurer—W. A. WRIGHT.

As a sensible business man Mr. Wright's first move was to secure the services of an experienced and competent mining captain, whom he found in the person of Martin Welch, whose ability as a miner had been demonstrated at the Republic, in whose service he had held a responsible position for many years. The first thing to be done was the unwatering of the old pit, which being accomplished, a crib shaft was put in, and Capt. Welch, after a close inspection, arrived at the conclusion that the main ore body, if there were any, lay under what the former management held to be the hanging-wall, but which he at once distinguished as the foot-wall side of the vein or deposit. His first work, therefore, was to put a hole into the mixed slate ore and quartz, which, to his great satisfaction, he found to be only from a foot and a half to two feet thick, the first blast revealing an apparently solid body of clean looking slate ore, (very similar in appearance to the Champion and Republic slates), immediately beyond. At the time of the writer's first visit from three to five hundred tons of this ore had been raised to the surface, while a shot just previously fired had thrown to the bottom as much more. At that time a drift had penetrated about 20 feet into this slate ore without encountering any wall

or rock except the thin stratum spoken of, while the shots fired from above had revealed a solid face of ore, where in the beginning of present operations, nothing was to be seen except the mixed slate ore and quartz. Since then a shaft has been sunk 51 feet below the old bottom, and a drift cut into the hanging to the north-east, which passed through two or three feet of soap-stone, about 9 feet of ore and then again into soap-stone. The ore cut in this drift is a martite, apparently of very fine quality. The shaft in the bottom is all the way in ore, which appears to improve very much in sinking; the bottom of the shaft is all clean ore, except a stratum of soap-stone on the foot-wall side corresponding exactly with the formation above. To the south-west a short drift for a sump is being cut into the hanging in mixed ore, though it is known that pure ore lies immediately beyond it—or, at least, that is the fact on the level above. A winze is going down near the shaft with a view of leaving a pillar to support the walls, and this too is in ore. No other work is being done underground, the intention being simply to prepare the mine for active work by the time transportation facilities are secured, for which a determined effort is now being made. An examination of the workings convinces us that there is a large body of ore at the Erie, but it is so cut up with alternate stratifications of soap-stone that it will require very careful mining. We noticed, too, that little bunches of quartz are frequently to be seen in the ore which came from the upper level; but these seem to have entirely disappeared at the bottom of the shaft. These bunches of rock are, however, peculiar to the slate ore, the martite being, to all appearances, perfectly clean. The formation is a most perplexing one, having apparently been subjected to some great disturbance which has thrown the different rocks into a rather confused mass. It is probable that the diamond drill will reveal settled ground at the depth at which it is expected to cut the ore below the present bottom, but if it does not there is still plenty of ore in sight upon which to predicate the confident anticipation of a paying mine in the near future. The ground at and around the present workings is being thoroughly explored with a diamond drill, and we look for the most gratifying results. There are no unfavorable features about the Erie, except those we have already noted, and these are most likely to disappear as the mine work progresses and the miners get further away from the disturbance alluded to.

Since the present owners took the mine about 3,000 tons of ore has been mined and stocked, but this will need a careful re-sorting before it is shipped. This amount could, we think, easily be increased to 8,000 or 10,000 tons the present year were the mine supplied with the necessary shipping facilities, which last can only be had by a four-mile extension of the Columbia branch. About 35 men are employed, with Martin Welch as mining captain, the Messrs. Wright being on the ground and giving to the mine and its affairs their exclusive personal attention.

* * *

On this same range explorations are being prosecuted on the Magnetic, Cannon, Standard, and Metropolis properties, but so far with little success, except perhaps at the Standard, where it is claimed a shaft is down 25 feet in a vein or lens of ore 5 feet thick. We have this only from hearsay, the work having been temporarily suspended on account of the large flow of water, at the time of our visit. The information comes, however, from men who are not given to exaggeration, and we take it as being wholly reliable.

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* * *

At the Cannon, which property was recently leased by an Ishpeming company, work is being done at two different points where there are outcrops of lean ore, but as yet nothing of any value has been found. The developments are just promising enough to induce, and possibly warrant, the expenditure of more money in the hope of finding something better, and it seems hardly probable that well directed explorations can fail to ultimately reveal the existence of a workable deposit on this tract. The conditions are all favorable, but it is yet too early to refer to the Cannon as a mine.

* * *

At the Magnetic several holes have been drilled, in one of which 9 feet of ore, which analyzed 57 per cent., was cut, but the others were all barren. The drill is now boring in the old well at the large boarding house, and if it strikes ore at all it will be at a very considerable depth.

THE TAYLOR MINE

is in Baraga county—north-west quarter of section 9, town 46, range 33. Ore was discovered on the tract as long ago as 1872, but nothing was done in the way of development until the summer of 1880, when the property was leased to the Taylor Iron Company, by whom the mine is now being wrought. The shipments have been as follows:

	<i>Gross Tons.</i>
1880.....	1,110
1881.....	10,559
Total.....	11,669

The original workings covered about 200 feet in length of a deposit which appeared to, and did, carry a width of about 25 feet, the trend of the formation being east and west, the ore dipping to the north and having a steep pitch to the west. The ore in this old working was entirely exhausted in taking out the product above stated, the rock coming in on the bottom, thus indicating that the workings were located in the east end of a flattened lens. A shaft further west is down 125 feet in ore, and in a deposit which is from 40 to 60 feet wide, and which has been opened up by drifts and cross-cuts over a length of 86 feet, with the ore continuing and apparently growing wider to the west. One hundred and seventy-five feet further along another shaft is down 95 feet, but will probably not reach the ore in less than 125 feet more. The mine is now being wrought on the underground plan, and some idea of the extent of the deposit may be gathered from the fact that during the past winter about 6,000 tons was mined, and raised through one shaft, with no other machinery than a horse whim. It really looks as if the deposit might be a very large one, but it will require time to open it up sufficiently to secure a maximum of production. The ore is a first-class bessemer hematite, and the fact that those who used last year's product were prompt bidders for all the owners were willing to contract for this season's delivery is the very best recommendation that could be given it. A new plant of machinery has been ordered, and we look for a largely increased product over last year. The mine gives employment to about 40 men. H. E. Warner, Esq., is general manager, and John Skogberg mining captain.

THE SPURR MINE

is in the south-west quarter of section 24, town 48, range 31,

the most westerly opening on the magnetic range. It was at one time considered a mine of large promise, but owing to mismanagement which followed the first two years of its existence, it finally, in 1878, collapsed entirely, and passed into the hands of bondholders by whom it was subsequently sold to a new corporation organized under the name of the Spurr Iron Mining company, with general office at Detroit. Active work was commenced by this new company May 12, 1881, under the immediate supervision of Mr. A. C. Davis, an experienced Lake Superior miner. In consequence of the entire abandonment of the mine for so long a time, the first work was to free it from the water which had flooded every part of the old workings, and, owing to the poor condition of the pumps, a longer time was consumed in this work than had at first been anticipated. The examination of the mine, when unwatered, showed no part capable of producing ore at once, and further, that the mine was in an insecure condition, owing to the robbing of the pillars. The business policy of the present management was at that time clearly outlined, and has been closely followed ever since. This has been to discourage entirely all explorations or anything looking to the future development of the property. One result of this course, which reflects not only on the mine, but also on the district, was the resignation and retirement of Mr. Davis from the superintendency of the mine. The entire work up to the present time has been confined to the immediate vicinity of the old No. 2 shaft, which was down to the first level, a distance of 100 feet. This shaft has been sunk one 70-foot lift, and is now being carried down another lift of 60 feet, being now 12 or 15 feet below the second level. At the bottom of the 70-foot lift, or No. 2 level, the jasper, which has been considered as forming the foot-wall, made more flat and cut partially across the shaft, and in order to put in the skip-road it was necessary to cut into it. In doing so the jasper was cut through in going two feet, showing behind the shaft a body of clean ore, the extent of which has not yet been determined. Two winzes have been sunk to the east and west of this shaft, from the 1st to the 2d levels, the one to the east being 7 feet from the shaft and the one at the west 40 feet. Above the first level the ore had all been stoped out to the west while to the east some stoping has been carried on the past year. At the No. 1 level a drift is in 10 feet to the east, and

above the No. 2 level one 16 feet, nearly all in ore. The entire work at the present time consists in drifting on the 2d level to the east, and in stoping out the ground to the west of the shaft on the bottom, where, owing to a flattening of the hanging-wall, there is a promise of a good body of ore. Among the underground improvements inaugurated by Mr. A. C. Davis and carried out by Mr. W. B. Davis, the present agent, may be mentioned the straightening of the shaft, by which two handlings of ore are saved, the putting in of a new sump and gutter, (a change badly needed), safer ladder-ways, and also an underground winding engine. To the plant of machinery has been added a new boiler, a compressor and six power drills, while important changes have been made in the pumps. On thing the mine needs, more than anything else, is a diamond drill, to locate future openings and facilitate the present work.

The annual product of the Spurr has been as follows:

	<i>Gross Tons.</i>
1873.....	31,933
1874.....	42,068
1875.....	23,094
1876.....	20,276
1877.....	22,801
1878.....	2,225
1879.....	1,409
1881.....	2,746
Total.....	146,612

* *

In the immediate neighborhood of the Spurr, south and west, several new and most important discoveries have been made during the past year. First and most notable among these is the Wetmore find, on the north-west quarter of section 25, town 48, range 31, which looks as if it might be the largest body of iron ore ever discovered in this district. The first explorations were made last summer, under the immediate supervision of Mr. E. A. Wetmore, who had made a careful study of the geological formation, and was satisfied that the conditions were most favorable to the existence of merchantable ore in the near vicinity. His opinion was verified by a comparatively small amount of work, ore being struck within a few days after explorations were commenced. The first discovery was made on the south half of the 160 acre tract, in a pit located about

900 feet west of the east line, and afterwards at a point 300 feet further east, where two pits, 50 feet apart cross-wise of the formation, are both down in ore. Going west of the pit in which the ore was first struck 200 feet, a line of pits, ten in number, were sunk across the formation, in order to test its width. These pits show the ore body to be, at the very least, 200 feet wide, the foot-wall being found in the most northerly exploration, and the hanging in the most southerly one. This last pit is really a shaft which has been sunk through the edge of the hanging-wall, and 25 feet into the ore, its entire depth being 43 feet. From the bottom of this shaft a drift was driven 30 feet north, all the way in clean ore, but both drift and shaft had to be abandoned on account of the great flow of water, the season having been an extraordinarily wet one. These pits are so close together as to afford very little room for doubt that the deposit is clean over the whole of the width stated, the bottoms of all being in ore. West of the center of this line of pits, 160 feet, there is another pit down in ore, west of that 165 feet still another, and 225 feet further along we come to a second line of pits across the formation, all of which are in ore of the same general character as that found in the other explorations. In this west line there are eight pits, and they show the deposit at this point to be fully 200 feet wide, with the hanging-wall yet undiscovered. In the side of the hill, 300 feet further west, ore is shown in another pit; thus it will be seen that the explorations cover a length of 1,350 feet lengthwise of the formation, while at the two points, 525 feet apart, where the formation has been, so to speak, cross-cut, the deposit is found to be at least 200 feet wide, making it, perhaps, the largest show of ore for the amount of work done ever known in this district. There are two kinds of ore in the deposit—a yellow ochre lying next to the hanging-wall, and under it, and constituting the larger part of the whole, what would at first glance be called a hard hematite. This last is, however, in the opinion of the MINING JOURNAL, really a first-class red specular, partly hydrated. This opinion is based on the fact that in every piece examined we found a bright crystalline ore in the centre, encrusted on the outside with a hydrate most probably formed by the water which has been leaching through the broken-up part of the ledge for ages past. The further fact that the proportion of bright ore increases and the incrustation decreases in going down

encourages the belief that an exclusively hard red specular ore will be found when the solid ledge is reached. An analysis of this bright ore gave 67.60 per cent. of metallic iron, 1.90 silica, and .065 of phosphorus, while other analyses made from samples taken at random, and without selection, ran from 59 to 63 per cent. in metallic iron.

The property is most advantageously situated for rapid and economical mining. The outlet of Three Lakes, a stream of very considerable size and steady flow, courses along the west line to a point near the south-east corner of the tract, where it makes a sudden bend, and flows along the base of the hill, in the brow of which the ore body lies at an elevation of from 50 to 75 feet above drainage. The river falls from 30 to 40 feet in passing around the tract, and can most readily be utilized for the propulsion of all the machinery that will ever be necessary in the operation of the mine—though the elevation is such that no machinery of any kind is likely to be required for several years. It is likewise easy of access by railway, and can be reached by a branch from the Spurr mine in a distance of less than one mile, over a route that will require very little grading.

The fee of this property is in the Michigan Land and Iron company, which recently became seized of all the lands embraced in the M., H. & O. R. R. land grant, which have been patented, and from whom Mr. Wetmore and associates have secured a lease. At the very least, it may be considered a most valuable property, with all the probabilities in favor of its development into a very large mine. No company has yet been organized to work this property, but Mr. Wetmore is proceeding alone in the work of development, stripping for two large open cuts, and making every preparation for the commencement of active mining as soon as a branch railway track is secured.

THE WEBSTER MINE

is immediately west of the property last described, on section 36. The explorations thus far made reveal a body of ore similar in character, and nearly, if not quite, as large as the Wetmore, with which it is undoubtedly continuous. It is the property, in leasehold, of the Webster Iron company, the officers of which are as follows:

President—G. N. NORTHROP;

Secretary and Treasurer—E. B. PALMER;

Directors—G. N. NORTHROP, DAN H. BALL, E. B. PALMER, E. M. WATSON.

The company is now stripping the deposit and getting ready to mine ore in large quantity as soon as they can secure the necessary transportation facilities, which can be had by a branch track of the M., H. & O. R. R. less than a mile long, and passing close by the Wetmore.

THE BEAUFORT

embraces the south half of the north-west quarter and the north half of the south-west quarter of section 22, town 48, range 31, and is the most westerly opening on the upper hematite range, if we except the Taylor mine, a continuous formation not having yet been traced that far. This mine is on lands leased by Jno. Thoney, George Thoney and Jno. McEncroe to B. M. Colwell, who subsequently transferred his lease to the Beaufort Iron company, of which last Mr. Sol. Curry is the general manager—the controlling interest being held by Milwaukee capitalists. The original explorations consisted of a series of test-pits covering a length of about 600 feet, and a width of 100 feet on the ore-bearing formation, and a shaft 40 feet deep with a drift of 20 feet, the whole exposing an apparently very large body of high grade mill ore. Stripping this deposit, and other preparations for active mining, are now being energetically carried on, while a large boarding house, barn and other necessary buildings are in course of erection. A branch track has been surveyed and finally located, and the rails will be laid in time to enable the company to ship all the ore that can be raised the present season.

* *

The same belt of ore has been found on the south-west quarter of the same section, on lands which are under lease to Dr. Northrop. It is, however, impossible at the present time to give more than a general idea of this upper hematite formation, and of the associated rocks, owing to the superficial character of the explorations thus far had. No true geological survey has ever been made, nor, in fact, any examination looking further than the mere finding of the ore. West of Michiganme, the first work on this range was commenced less than a year ago. East of the lake, while probably of the same age, certain local

causes seem to have modified the formation somewhat as to dip, position, etc.; at the west the ore belt lies above the black clay slates marked in the Brooks Report (XV) and conformable with it. These slates are highly charged with iron pyrites which decompose and form a hard cement or hard-pan wherever found in the drift. Between this slate and the ore often occurs a schist varying from a few inches to several feet in thickness, which is in places plumbaginous, carrying quartz and pyrites, and again a true actinolite schist. The ore is a limonite, either resulting from the decomposition of a hematite, or else associated largely with hematite. The whole surface of the vein or deposit is loose and decomposed, making it impossible to decide absolutely what the condition of the ore may be below the effects of this surface action. Where the vein is well defined we have on the foot-wall a compact black ore, with dull lustre and yellow or brownish streak. This ore is extremely hard and brittle, and shows the same evidences of decomposition going on. A marked characteristic of this ore is the small amount of silica it carries, ranging from $\frac{1}{4}$ to $1\frac{3}{4}$ per cent. It varies in phosphorus from .2 to .4 per cent., metallic iron about 60, and chemical water as high as 10 per cent. The expulsion of this water by heat leaves an ore carrying from 65 to 68 per cent. metallic iron. On the hanging-wall side the ore is a soft yellow and red hematite, higher in iron and silica than the black ore, and lower in phosphorus. Through this soft ore, either as detached fragments or as seams (the seams increasing in number and thickness with depth), is a bright specular ore which, analyzed separately, gives 67 to 68 per cent. metallic iron, 2 per cent. silica, and from .060 to .065 of phosphorus. From the presence of such different ores in the same vein a marked change may be expected in sinking. A friable quartz rock, in places almost a true quartzite, and again a silicious limestone, forms the immediate hanging-wall and constitutes the foreign material in the ore. This quartz when it occurs in the ore is distinct in seam and easily separated. Above this quartz occur certain decomposed schists and a greenish slate. What relation the green and black slates have to each other has not yet been determined. A record of work done would facilitate future operations in the district, and afford a better knowledge of its geology.

THE ORLEANS MINE

embraces the east half of section 23, town 48, range 31—and was formerly known as the Stewart, from which 2,987 tons of ore was shipped previous to 1879. The tract is under lease to the Orleans Iron Company for a term of five years, with an option for purchase at a stated price within one year. The ore in the old workings pinched out at a depth of from 50 to 75 feet, and the new lessees are now testing the ground with one of Bullock's diamond drills, which will cut the formation at a depth of 100 feet under the old pit. It is hardly probable that the worked out lens constituted all there was of value in the property, and we look for some valuable developments shortly.

THE MENOMINEE RANGE.

The first practical discovery of iron ore in Menominee county was made by the brothers Thomas and Bartley Breen, sometime previous to 1867, though the veteran explorer, S. C. Smith, claims to have been, and probably was, aware of its existence in that section as early as 1855, in which year he traversed what he called a new range, south and east from Lake Michigamme to Escanaba, locating what is now the estate of the Republic Iron Company on the way. The first practical work in the way of development was done by the Milwaukee Iron Company at the Breen and Vulcan mines in 1872, and by Hon. John L. Buell, at the Quinnesec the following year. The work done by these last mentioned parties established beyond question the superior quality of the Menominee ores, but their further development was necessarily delayed until such time as the requisite means of transportation to the lakeside could be secured. These were, after years of patient waiting, supplied by the building of the Menominee River Railroad (a branch of the Northwestern, by which company it is operated), which was completed to the Breen and Vulcan mines in the fall of 1877, and to Quinnesec the following spring. Since then the work of development has been pushed with such vigor that to-day the Menominee Iron Range, or district, ranks second only to the Marquette range as to quantity, while it concedes to no other iron field in America superiority as to the uniform and good quality of its ores. How

rapid its progress has been may be inferred from the following table showing the annual output of its mines during the past five years:

	Gross Tons.
1877.....	10,405
1878.....	94,245
1879.....	239,069
1880.....	592,193
1881.....	739,135

Total.....1,705,067

Contributed by the several mines as follows:

Breen.....	17,328
Chapin.....	169,077
Cornell.....	42,557
Commonwealth.....	107,053
Curry.....	52,188
Cyclops.....	79,198
Emmet.....	66,003
Florence.....	114,644
Hewitt.....	4,352
Keel Ridge.....	30,507
Ludington.....	12,190
Norway.....	416,137
Perkins.....	123,067
Quinnesec.....	164,026
Stephenson.....	34,123
Vulcan.....	272,617

Total.....1,705,067

The product of the several mines in 1881 was as follows:

Chapin.....	134,521
Commonwealth.....	97,410
Cornell.....	11,816
Curry.....	17,534
Cyclops.....	12,644
Emmet.....	648
Florence.....	100,501
Hewitt.....	4,352
Keel Ridge.....	19,011
Ludington.....	3,374
Norway.....	137,077
Perkins.....	60,406
Quinnesec.....	43,711
Stephenson.....	10,856
Vulcan.....	85,274

Total.....739,135

It will be noticed that the number of mines from which ore was shipped in 1881 was the same as the year previous—the only difference being the substitution of the Hewitt for the

Breen. Contrary to the general expectation the extensions of the Chicago & Northwestern to the new mines on Iron and Paint rivers, and the branch to the Felch Mountain range were not completed last year, which accounts for the fact that the Hewitt was the only new mine added to the list. Thus it will be seen that the increased product of 1881 came altogether from the old mines—or rather, we should say from those wrought the previous year—and was not due to the development of new properties, a number of which last will be supplied with railway facilities the coming summer and fall. The Crystal Falls extension is finished, and trains running to the mine of that name, while the Felch and Iron River branches are well under way, and will probably be completed in time to enable the mines in those localities to ship a very considerable product before the close of navigation. The completion of all these lines will double the number of shipping mines in the Menominee range, and it is not unreasonable to anticipate a largely increased output the present year. The older mines will mostly hold their own—the Chapin will very nearly, if not quite, double her last year's product—while the new ones may be expected to contribute an amount equal at least to the increase shown in 1881, as compared with the previous year. In fact, we look for a product crowding close upon a million tons from the mines of this range in this the sixth year of its practical development.

THE MENOMINEE MINING CO.,

which owes its existence to the keen foresight and indomitable will and perseverance of J. J. Hagerman, Esq., until lately owned in fee simple, or in leasehold, no less than six of the mines embraced in the foregoing list—the Vulcan, Cyclops, Norway, Quinnesec, Chapin and Florence. Recently, however, this company has sold to the Cambria Iron Company, of Johnstown, Pa., all but the two last mentioned mines, for a consideration of \$1,800,000, though it is understood that the sale was made subject to existing contracts, and that the Menominee company will continue in possession of and operate the mines in question until the close of the present year. The four mines included in the purchase yielded no less than 278,706 gross tons last year, the value of which, on the cars at the mine, was over one and a quarter million dollars. The Cambria company has heretofore imported a large portion of the ores used in its

furnaces, and this purchase will make it a steady consumer of Lake Superior ore to the extent, at least, of the amount which these mines may hereafter be made to yield, and which will, of course, make room for an equal amount of other ores in our home markets. The effect cannot be otherwise than beneficial to the iron mining interests of this section, aside from the testimony thus proffered in behalf of the superior quality of our Lake Superior ores.

Of the mines named in the foregoing lists those operated by the Menominee Mining Company are to be credited with 513,728 tons of the whole amount raised in 1881, and with 1,215,699 tons of the entire output of the district since the beginning—about 70 per cent. of the whole.

The most easterly of the mines on this range is the Emmet, of which the Emmet Mining Co. held a lease until last summer, when the mine was, for some reason, abandoned and the lease surrendered. Since then the mine has been idle, but it is now said to be under option to Chicago parties who are expected to resume operations in the near future. Next adjoining the Emmet is the old Breen, which is now under lease to the Maryland Iron Mining Company, by whom it is now being wrought, and, the managers of which claim, with the most gratifying results. However, we shall leave this mine for comment when the work now in progress is much further advanced, as it will be before this review reaches a conclusion.

THE VULCAN

is the most easterly of the mines named as belonging to the Menominee Mining Company. The workings cover a length of nearly two miles, on the line of the ore bearing formation, in sections 9, 10 and 11, town 39, range 29—the most easterly pit being on the line between sections 11 and 14, and the most westerly in the north half of section 9, the trend of the formation being from south-east to north-west. The workings in section 11 are known as the East Vulcan, and those in 9 and 10 as the West Vulcan, each group having a mining captain of its own, though all under the direct management of one agent or superintendent. Capt. John Curnow, a miner who has had years of experience in the largest copper and silver mines of the country, is in charge of the underground work at the East Vulcan, and Capt. Enoch Roberts, formerly with Captain Pascoe,

at the Republic, occupies a similar position at the west end pits. Hon. A. C. Davis, one of the pioneer mining superintendents of the Lake Superior copper district—a most agreeable gentleman, withal, and without a superior in his chosen vocation—is the superintendent, under whose direction some important and valuable changes have been made in the general mining plan. These changes have not yet been prolific of results, but they may be likened to the good seed which, properly planted, is sure to return an hundred fold in the end; their practical value is certain to be demonstrated by an increased output the present year, notwithstanding the fact that they cannot be fully matured until late in the season. The character of these changes can be noted by the reader who follows us in our necessarily brief review of the present condition of the several workings.

There are three pits at the East Vulcan, numbered 1, 2 and 3 respectively. There are, or have been, at this point two distinct lenses of ore—the Lowell vein of red ore, and what is or was known as the chimney of blue ore—the latter being of exceptionally fine quality, and the other rather below the grade of first-class. The indications now are that the blue ore cuts the other out, and that in sinking one more lift the two will be found to have settled down into one main deposit of blue ore, than which there is none better anywhere on this range. A new perpendicular double-cage shaft is going down in the Lowell part of the working. This shaft, which will be sunk to a present depth of 300 feet, will be supplied with two cages, one of which will be used for hoisting ore to the surface, and the other for sinking when it may be deemed necessary to go deeper, and for lowering timber, one of the two compartments being sufficiently large to afford room for a pump column and a ladder-way. A short drift, on the present lower level, will connect this shaft with the blue ore, the connection, at the time of the writer's visit, being nearly completed. And right here, in addition to the new shaft, which is the finest piece of work of the kind we have ever seen anywhere, we note the first and principal change in the general mining plan—one which, by the way, is being made at all the East Vulcan pits. This is nothing more nor less than the adoption in full of the Nevada system of mining and timbering, of which system that now in vogue at the West Vulcan, Chapin, and some other mines is a modification. A commencement on this plan has been made in the

blue ore deposit, in which, on the bottom level, a low chamber 25x40 feet has been opened out, and in which, at the time of the writer's visit, (May 8), the first sets had been placed. The system is substantially the same as that described in our last annual review in connection with the West Vulcan, except that no long timbers are used, the plan being to secure every foot of ground as fast as the mine work progresses. It is enough in this connection to say that the innovation, if such it can properly be called, is one which will, on inspection of Capt. Curnow's work, commend itself to any practical miner of ordinary intelligence as certain to mark a new and important era in the history of our iron mines. A close inspection convinces the writer of the perfect adaptability of this system to the wants of this region; that there is no necessity, where timber is so abundant as in this region, for leaving great pillars of valuable ore to support walls which can, through this system, be made perfectly safe and secure. The timbers are all framed and made ready to be set up above ground, and, none of them being over eight feet in length, they can be lowered to the bottom with the utmost facility, where three or four men can handle them with perfect ease. When in place sufficient room is left for tram-roads in any and all directions, and it is utterly impossible for any considerable or dangerous run of ground to occur. At the risk of appearing somewhat officious the writer ventures to suggest to mine superintendents that they will run great risk of learning something to their own advantage by a visit of inspection to the underground workings of No. 1 pit, East Vulcan.

When the shaft is down, and the connections made, mine work in this pit can be prosecuted to much better advantage than has heretofore obtained at any of the mines of this company. All parts of the workings will be made tributary to the shaft, the tram-cars running direct from the stopes upon the cage in which they will be hoisted to the surface, and the contents dumped directly into the pockets or upon the stock pile. In the meantime, while one level is being stoped out, the shaft will be sunk another lift of 100 feet, it being the intention to always have plenty of ground opened ahead of the miners.

There is apparently a large body of ore at this point, there being ore on all sides of the chamber referred to on the bottom level, while there is a large amount that can be secured when

the proper time comes, by taking up the timbers at and around the old shaft in the blue ore deposit. Whether there be much or little of it, however, the local management proposes to take it all out clean, rather than timber a part of it in, as is being done in many of the mines on both ranges. A new plant of machinery consisting of a 10x12 duplex Rochester engine, with two 52-inch drums, and a 12x24 Frazer & Chalmers engine for the operation of a 15-inch Cornish plunger pump, will shortly be set up in this pit.

No. 2 is the most easterly pit, and like No. 1, is being metamorphosed into an entirely new mine. A new double cage shaft, similar to that in No. 1, is going down to a depth of 300 feet at the west end of the old open cut, which is being filled up with debris from the underground workings. This shaft will open ground to a height of 90 feet for back-stoping, it being the intention to prosecute mine work on the true Nevada system, as in No. 1. In this pit the ground is rather "bunchy," but the ore is of a very superior quality. Going through the underground workings, the trend of the formation would appear to be nearly due east and west, which is accounted for by the fact that the workings are immediately on the east and west line between sections 11 and 14, beyond which the miners cannot go without trespassing upon the rights of others, no matter how much ore may present itself in that direction. The ore appears to lie in the middle of the ore bearing formation, with banded ore and jasper on both sides of it, though we thought we could see not a little ore which had been left standing on the south or hanging-wall side, the dip of the formation being unmistakably to the south and the pitch to the east. It is the opinion of the writer, as well as of others better informed in such matters, that other lenses will be found by cutting through the banded ore north and south, and that the one now being wrought will most probably be found larger and more regular when settled ground is reached, the formation at this point having evidently been subjected to unusual disturbance. No other than preparatory work has been done at this pit the past winter, notwithstanding which fact some 1,500 tons of ore was raised, simply in sinking and drifting. When the shaft is down to the first, or 300-foot station, mine work will be commenced in earnest, and a large daily output is certain to follow.

At No. 3 another vertical shaft is down 175 feet in ore.

This shaft has two compartments, same as the others, though only one cage will be used at present. It is located some distance south of the deposit, and is simply a vertical continuation of the old shaft below the point at which it was diverted on an incline into the deposit. From the bottom of this shaft a drift runs under the old workings, in which there is now from 5,000 to 7,000 tons of ore in sight.

At the west Vulcan there are four working shafts in operation—Nos. 1, 2, 3 and 4—in what are now known to be two distinct and separate veins or lenses of ore, lying parallel with and lapping each other. The trend of these lenses, which are about 500 feet distant from each other, is nearly east and west, with southerly dip, the pitch of the south lens being to the west and that of the other to the east.

No. 1 pit is in the south lens, and is 300 feet deep and at least 300 feet long, in a body of ore which varies from 5 to 90 feet in thickness. This pit is being wrought on the modified Nevada plan described in our last annual review. The ore is mined out in chambers 20 feet wide, extending from foot to hanging-wall, leaving alternate bodies of ore 17 feet thick the whole depth of the workings, and unbroken, except where cut by the working drift on the foot-wall side, at the bottom of each succeeding level. It will thus be seen that less than two-thirds of the ore is mined out, the balance being left with the erroneous idea, as the writer believes, that it is necessary to the support of the walls. The plan involves the timbering in of a large amount of valuable ore, which it should be the principal aim and purpose of the management to take out—and Capt. Curnow, at the East Vulcan, is showing how that can be done, with less risk of accident to life or property than is involved in the "modification" of his plan—or rather, we should say, of the Nevada system, which he has been the first to introduce into this region. If the present management of the Vulcan is continued by the new owners, we shall miss our guess if the great bodies of pure ore which have been left as supports at the west Vulcan, do not right speedily find their way to the surface, and the product of the mine thereafter be proportionately increased. There is a large amount of ore at this point, as may be inferred from the fact that the lens has gained at least 50 feet in length and 10 feet in thickness within the past year, the westerly pitch giving an increased length on each suc-

ceeding level. They are now opening up the 4th, while there yet remains considerable ground to break above the 3rd level.

Some distance south of No. 1 there is a timber shaft down through the rock to the bottom, which is used exclusively for lowering timber into the mine. This shaft is operated by a drum at the new compressor house, erected since our last annual review, and in which there is a 20x24 Norwalk compressor, and the pumping engine for No. 2 shaft. This building is of stone, and located near No. 2 shaft, which is about 200 feet west and north of No. 1, and some 50 feet back in the foot-wall of the south deposit. This shaft has two compartments, one for hoisting and one for pumping, is supplied with a 12-inch Cornish plunger, and is down 200 feet, with cross-cut to the south deposit, and sinking another lift of 70 feet. On the next lower level a cross-cut will be made to the north deposit, the dip of which will at that depth bring it within 170 feet of the shaft—the intention being to raise a large part of the ore mined in the north deposit through this shaft. The dip of the north deposit is much flatter than that of the south lens, which fact encourages the belief that they will finally come together at some point below the bottom of the present workings.

No. 3, 500 feet west and north of No. 1, is down 300 feet, and connected at the bottom with No. 4, some 300 or 400 feet to the eastward. At the time of our last annual review No. 3 was referred to as a pit in which there were three skip-roads reaching to a depth of 200 feet, in as many shafts which were connected at the bottom. These skip-roads have all been abandoned, the product of the north deposit now being all raised through shafts 3 and 4. In No. 3 there is at least four months' work remaining on the 3rd level, while the shaft and winzes are down, or going down, to the 4th. No. 4 is down 275 feet in workings which show, on that level, from 5 to 25 feet of ore extending over a length of 500 feet. Here the ore is all being mined out, if we except the pillars left to protect the shaft, and an occasional block where the ground is unusually weak, stulls being put in to support the walls. A small pump-house with engine, near the shaft, operates a 10-inch plunger pump, which is so arranged with a globe-valve that in case of accident a steam-pump can be attached and made to do the work through the same column.

From No. 4, on the second level, an exploration drift is being driven north to the limestone, in the hope of finding another lens which is believed to lie in that direction. At the time of the writer's visit this drift was in 310 feet, in heavy soapstone, having passed through 10 feet of banded ore. It will probably strike the limestone in 100 feet more, and the superintendent feels confident that it will before then develop something of value.

The annual output of the Vulcan, since the beginning, has been as follows:

	<i>Gross Tons.</i>
1877.....	4,593
1878.....	38,799
1879.....	56,975
1880.....	86,976
1881.....	85,274
Total.....	272,617

It is the intention of the management to resume work at the old openings in section 10, where there was originally a good show of ore, but which were abandoned "because the bottom looked poor." These deposits have never been properly worked, and there is every reason to believe that at this point the history of old No. 1, which at one time showed equally as poor in the bottom, will repeat itself in the development of a regular and well-defined lens. In fact, the management evinces a determination to institute a series of thorough and well directed explorations all along the line between the east and west groups hereinbefore described, and it is scarcely possible that such explorations can have other than satisfactory results. A new saw-mill is being erected near old No. 2 pit, for the purpose of supplying the mine with square timbers, plank, &c.

The machinery at the Vulcan is, aside from the exceptions noted, the same as last year. With one or two exceptions the drums are too small, and other and larger ones will be an absolute necessity in the near future. Among the new improvements is a commodious blacksmith and machine shop—both departments of which are well equipped—and a large warehouse, in which the mine supplies of all kinds are safely stored. Under the present management the tenements have all been either painted or whitewashed, while the location generally has been cleaned up and renovated in such a way as to conduce in the highest degree to the health and comfort of the

company's employees. The entire force numbers about 500 men, a larger number than will be necessary when the preparatory work now in hand is completed. A large amount of clearing is being done, besides other work of a permanent character, and when this is completed the force can be materially reduced without in the least impairing its efficiency or curtailing the annual production. Shipments began this year from stock piles aggregating 30,000 tons, and we look for an increased product, notwithstanding the fact that most of the preparatory work commenced since the first of the year, is yet far from being fully completed. Altogether, the mine is a most promising one. By this we mean to be understood as saying that, under the new system, it promises a great improvement over the very gratifying record it has already achieved. When the new shafts are completed, and the new system fairly inaugurated, an annual product of 100,000 tons will be the minimum rather than the maximum of its capacity.

THE CURRY MINE

commenced shipments this year from a stock-pile of some 9,000 tons, her annual product having been as follows:

	<i>Gross Tons.</i>
1879.....	12,803
1890.....	21,851
1881.....	17,534
Total.....	52,188

No. 1, which was until recently considered the main deposit at the Curry, was found to be a large pocket, the rock coming in on all sides and in the bottom, cutting the ore out entirely. Consequently the pillars which had been left to support the roof have been taken out, and the pit has been permanently abandoned. The management met with another provoking disappointment in sinking a shaft 180 east of No. 1, where the diamond drill showed 13 feet of clean ore. In sinking to a depth of 100 feet the drill was found to have struck and followed a mere seam or leader of ore not over two feet thick, and the shaft was abandoned, though it is believed, and with good reason, that this seam must be a leader branching off from a main lens or deposit near by. What the mine has lost in this direction it has, however, gained in No. 2, in which the shaft is down 160 feet, the first 70 feet being perpendicular to a point from which the ore dips at an angle of about 20 degrees

to the south. The pitch is to the west, and the lens, which is only 60 feet long on the 140-foot level, has lengthened out to 150 feet on the present bottom, and appears to be widening out rapidly going west. A drift has been run west on the 160-foot level, all the way, and still continuing, in ore. The miners are now pushing a stope west, following this drift, a cross-cut at the west end of which shows the lens to be 20 feet wide. This drift will be continued west as long as the ore is found, or at least to the west line of the company's tract, 500 feet further along. A new shaft 210 feet west of No. 2, is on its way down to the ore, which it will reach at a depth of a little over 100 feet from the surface, which last falls away about 50 feet just west of No. 2. If the ore is found continuing west any considerable distance beyond No. 3, another shaft will be put down, and still another, should it be found necessary. These developments give a new lease of life to the Curry, which, when the new shaft is down, will be in a condition to increase her production over any previous year. As it is, we look for an increase over last year's product, notwithstanding the fact that the new shaft will not be ready for use before the last of August. A new plant of machinery, consisting of a 60-horse power engine and two 4-foot Lane drums, has been ordered, and will soon be set up and put into operation. The mine gives employment to a force of about 65 men, all told. Wm. Ross is agent, and William Trebilcock, an experienced miner, mining captain.

THE BRIER HILL MINE

is in section 9, immediately west of the Curry, and is the property in leasehold of the Brier Hill Mining Company, the shareholders of which are principally heavy iron manufacturers of Youngstown, Ohio. The tract embraces 80 acres, on the east 40 of which, and adjoining the Curry, the mine is located. Work was commenced last year under supervision of S. P. Saxton, Esq., the Lumbermen's Mining Company having previously done some work, but without success.

The workings consist of a main shaft 190 feet deep, from which drifts have been run and the ore stoped out east and west on three different levels, the lower one of which is 25 feet above the bottom of the shaft, now on its way down to the 4th level. The trend of the formation is east and west, the ore dipping about 75 degrees to the south and the pitch being 45

degrees to the west. The foot-wall is a lime-stone lined with soap-rock, and the hanging black slate and jasper. East of the shaft the lens is small, but to the west it widens out to a width varying from 10 to 20 feet, the greatest width being at the extreme west end where the ore pitches under the rock-capping. On the first level there is only 30 feet of ore west of the shaft; on the second it lengthens out to 55 feet, and on the third to 80 feet. At this last point the lens is at least 20 feet wide, and there is a perceptible gain in thickness along its whole length. What it will make in the next lift remains to be seen, but there is every indication that it will continue to grow in size, the ore still continuing to pitch under the rock to the west, and rapidly growing wider in that direction.

Shipments will commence when the side-track now building is completed, from a stock-pile of not less than 8,000 tons. A trestle-work 400 feet in length connects the shaft house with the pockets at the side-track, over which the ore will be conveyed in tram cars. The plant of machinery consists of a Root sectional safety boiler, a 7x10 duplex Rochester engine and two 3-foot drums. About 80 men are employed, only 30 of whom are miners. W. H. Mack is superintendent, and Thomas Williams, formerly of the Norway and Ludington, mining captain.

About two miles east of the most easterly pit of the Vulcan, on the east half of the south-west quarter of section 7, town 39, range 28, is the

STURGEON RIVER MINE,

which is the property in leasehold of the Sturgeon River Mining Company, of which John M. Douglas, Esq., is president, and G. C. Benton secretary and treasurer. Work was commenced early in 1881, at a point near the west line of the company's tract, where a shaft was sunk 25 feet in blue ore, from the bottom of which a cross-cut was made north 17 feet to the foot-wall and 20 feet south, all in ore, except about 2 feet of slate, which was encountered 8 feet south of the shaft. A drift 50 feet west is all in ore, but one going east struck the horse of slate, which curves round to the north and cuts the ore off. The shaft was then sunk to a further depth of 25 feet, where a cross-cut shows 18 feet of ore. An easterly drift, however, struck the horse of rock, which appears to be coming in and

cutting out the ore in the bottom. Thus far this rock has not been cut through to see if the ore does not make around or beyond it, which we think should be done. About 100 feet south another shaft is down 100 feet, from the bottom of which a drift north, after passing through 20 feet of mixed ore and slate, cut 22 feet of clean blue ore of the very best quality. Into this ore a shaft or winze has been sunk 8 feet, but finding it difficult to keep the water out, work at this point has been suspended. It is now the intention to mine the ore out of the "pocket," as the owners call it, and drift from the bottom into the south lens. The trend of the formation is nearly east and west, and an examination of the shaft and drifts in the north deposit would seem to justify the belief which has obtained with the management that the dip is high to the north. This is, we think, a mistake; our theory is that the dip is to the south, and a fault or throw in the formation has shoved the ore over in that direction at some depth below the bottom of No. 1 shaft. Further work will, we believe, prove this last theory to be the correct one—the huge pocket at No. 1 West Vulcan being an illustration exactly in point.

Those well posted estimate the amount of ore in sight at the Sturgeon at not less than 8,000 tons, and the indications point unerringly to the speedy development of a paying mine.

THE GARFIELD MINE,

so-called, is in the north-west quarter of the north-west quarter of section 13, town 39, range 28. Some work of a desultory character has been done on this property, but as yet no well directed effort has been made looking to the development of a mine. The ore bearing formation certainly crosses the tract from east to west, and it is the generally expressed opinion that the property itself is not to blame for the absence of a fairly well-developed and remunerative mine. It certainly has never had a fair test, and the fact that the little work done discovered indications of a promising character seems to justify the openly expressed belief that a game of "freeze out" is being played, in which the small shareholders stand a good chance of losing the few "chips" they have left.

Cornering with the south-east quarter of the south-east quarter of section 11, in the extreme south-east corner of which No. 2 pit of the East Vulcan is located, is the

IRON RANGE MINING CO.'S

leasehold of 40 acres—the north-east quarter of the north-east quarter of section 14, town 39, range 29. This may be considered, in view of its close proximity to the East Vulcan, and the promising character of developments now being made upon it, a most valuable property. The underground workings of the East Vulcan pit are gradually being extended eastward to the corner post, the trend being north of west to south of east, and the ore dipping to the south. That it extends across the line upon the Iron Range Co.'s tract is proved by the fact that no true hanging-wall has yet been found in the East Vulcan, and that the same blue ore has been found 200 feet east of the line between the two properties, where a shaft is now going down partly in clean and partly in mixed ore. This shaft is down about 40 feet, the clean ore covering about 2 feet of the bottom on the south side, and the formation conforming in all respects to that of the East Vulcan. South of this shaft about 50 feet the diamond drill bored into 10 feet of clean blue ore at a depth of about 90 feet (boring at an angle of about 65 degrees to the north), when it was withdrawn. The drilling was done under the auspices of former lessees who considered the boring a sufficient showing upon which to predicate a sale of their option, they not desiring to engage in actual mining. It is believed that the ore in the shaft, which is precisely like that of the East Vulcan, and which is gradually making larger in sinking, is a leader to the deposit penetrated by the diamond drill, and which it is thought can be reached by sinking and drifting a distance of not more than 60 feet further. About 200 feet further east a shaft was sunk 107 feet in the slates, from the bottom of which a drift 57 feet south cut a formation in all respects identical with the underlying rock of the East Vulcan—mixed ore and jasper. For some reason the management suspended work in this drift just at a point where the ground was most promising, and, as we believe, within a short distance of the clean ore. The ore coming from the shaft first referred to is equal in quality to any found on the range, and the development of this property into a paying mine is a question of short time only—a belief of ours which is corroborated by the opinion of the best mining men in the Menominee district.

THE PERKINS MINE

comes next in order, going west on the range. A careful in-

spection of the underground workings reveals a marked improvement in this mine throughout their entire length. The horses of rock which were spoken of in our last annual review as being encountered in the upper levels, have entirely disappeared in sinking a single lift of 60 feet, while the ore body has gained very perceptibly in thickness. The workings, which are wholly underground, cover a length of nearly 600 feet, in a lens of ore which will average 25 feet between walls, extending from the Norway line east the distance named to a rock-crossing which is gradually cutting out the ore in the bottom. There are now three hoisting shafts—Nos. 1, 2 and 3—the number 2 of last year having been abandoned and the numbers changed accordingly. No. 1, the most westerly of these shafts, is located 140 feet east of the Norway line, and is down to the 4th, or 200-foot level, and sinking to the 5th. Here 15 feet of the floor of the third level has been left as a roof to the fourth, the shaft being cribbed up to the surface, and the vacant space above the roof thus formed filled in with waste material. The stopes in this part of the mine cover a length of 140 feet west and 100 feet east of the shaft, most of the ground on the 4th level yet remaining unbroken. When the shaft reaches the 5th level, toward which it is now well on its way, two more stopes 40 feet high and from 25 to 30 feet wide will be secured, when mine work can be prosecuted on both levels at one and the same time. The shaft is carried down 50 feet in each lift, though the stopes are only 40 feet, the bottom 10 feet of the shaft being left as a sump.

No. 2 (No. 3 last year), is 200 feet east of, and down to the same depth as No. 1. The stopes are about the same size, with about 40 feet of ground remaining intact west of the shaft, and 100 feet east of it, above the 4th level. This shaft is likewise on its way down to the 5th level. East of No. 3 shaft some distance the crossing of mixed ore and jasper occurs, and owing to its westerly pitch is gradually cutting out the ore, though there is every reason to believe it to be merely a wedge, beyond which, to the eastward, the ore will again be found. This crossing has not been cut through, for the reason that Captain Perkins has been afraid of getting too near the surface, and possibly cutting through into the sand drift, which is very deep and heavy in that direction. A drift into and through this poor ground will, however, be made on the 5th level, and the

writer ventures the suggestion that the theory above hinted at will be found the correct one.

It is noticeable that while the ore body has gained at least 5 feet in thickness, since our last report, there is now nothing but clean ore between the walls, the ore itself having likewise improved in quality. New shaft houses have been erected at 1 and 2, which are now supplied with skip-roads in place of the buckets and derricks in use at the time of our last annual report. About 25,000 tons were raised between the close of navigation and May 1, and the superintendent estimates that he will be able to mine and ship this year a product as large as that reported for 1881 in the following table:

	<i>Gross Tons.</i>
1879.....	13,465
1880.....	49,196
1881.....	60,406
Total.....	123,067

No new machinery has been added the past year, except a pair of small hoisting engines for sinking. Capt. John Perkins remains in charge as superintendent, the mine giving employment to a force of about 160 men all told. Altogether the mine is in excellent condition, and we shall not be surprised if at the close of the season Capt. Perkins, who, by the way, is a most excellent miner, shall find the product several thousand tons larger than his estimate.

THE NORWAY MINE,

which is in section 5, town 39, range 29, is, or was until recently, justly regarded as the most remarkable soft ore mine ever developed in this country; as it is, but one other (the Chapin) excels it in the magnitude as well as the quality of its ores. The mine is now in the fifth year of its existence, having mined and shipped an annual product as follows:

	<i>Gross Tons.</i>
1878.....	7,276
1879.....	73,619
1880.....	198,165
1881.....	137,077

Total..... 416,137
which is the largest aggregate output ever achieved by any exclusively soft hematite mine in the Lake Superior district. From an attempt to intelligently describe the underground workings of

this really great mine, the writer would most gladly excuse himself on almost any plausible pretext, but from a sense of what may justly be termed a self-imposed duty. While the workings were wholly above ground, in fact merely a series of open quarries, it was comparatively an easy task to draw a pen picture which would convey to the general reader an intelligible idea of their condition; but now that a large part of the workings are underground, embracing in their ramifications drifts and chambers extending over a length of at least three-quarters of a mile, an accurate and comprehensive description, without the aid of a competent draughtsman as well as engraver, is an utter impossibility. Your average newspaper reporter, however familiar he may have become, through long practice and experience in that line, with mining affairs generally, will on an underground visit to the Norway lose his powers of reckoning while traversing the labyrinth of drifts and chambers, and finally return to the surface with no well defined idea, other than that he has seen an immense amount of ore, which, if not practically inexhaustible, certainly cannot be exhausted in a great many years to come. It is really a great mine, the capabilities of which must not be judged from the output of a single year, and one of which even an expert is incapable of forming a correct opinion unless he devotes much more time to an examination than the single day allotted to the writer hereof for that purpose. The workings cover a total length of something over 2,000 feet on the ore-bearing formation, the trend of which is from north-west to south-east with southerly dip. There are four working shafts, numbered 1, 2, 3 and 5, respectively, and five pits—4, 6, 7, 8 and 9—the first four being large open cuts, while the last, though partially open, may more properly be called an underground working. It will be remembered that there are, or rather were, at the east end, two distinct and parallel lenses of ore, which, as shown by the first workings, were about 100 feet distant from each other. These were and still are called the Perkins and Stephenson veins, owing to the fact that they are western extensions of the deposits at the two mines of that name which lie immediately east of the Norway. No. 2 shaft is in the north, or Stephenson lens, and No. 1 in the Perkins, and both are now down to a depth of 215 feet below the level of the railway, as is also No. 3, which is located 155 west of No. 1, tapping the same lens. These shafts are not

laid out at right angles with the formation, the incline being more to the west than the south, as is shown by the fact that while the collar of No. 1 is 235 feet from the east line of the tract, at the bottom the distance is 160 feet, the same feature being observable at Nos. 2 and 3. In both these lenses the ore has all been mined out above the third level, while work has just been commenced on the fourth in back-stopes of 65 feet. East of No. 1 shaft the ore body averages 40 feet in width for a distance of 80 feet, starting from the Perkins line and going west, to where a fault occurs in the formation. Beyond this fault, which is 80 feet west of the line in the Perkins lens and 90 feet in the Stephenson, there was 30 feet of poor ground on the upper levels; but on the 4th this is now all good, while there is some poor ground east of the fault. The Stephenson vein, east of the fault, is about 20 feet wide. West of No. 1 shaft there is a run of ore 10 feet thick and 80 feet long on the 3rd level, though there is a middle vein or lens, 15 feet wide, lying between the Perkins and Stephenson. At the end of the 80 feet mentioned these three lenses come together and form a body of ore 65 feet wide and continuing 60 feet further west, where they again separate into two distinct veins or lenses, the Stephenson carrying a width of about 15 feet and growing poor going west, while on the other hand, the Perkins makes larger and better, increasing from 15 to 25 feet in width in going a distance of 210 feet, which carries it 160 feet west of the bottom of No. 3 shaft, the ore still continuing west. This has reference to the third level, above which the ore has all been mined out, the size of the lens being shown by that of the worked out chambers. On the fourth level, 65 feet below, the Stephenson and Perkins veins come together at one place, while at most there is but about 2 feet of soapstone between them, thus indicating to an almost absolute certainty that in sinking another level they will be found constituting one solid ore body of goodly proportions. From the west end of the Perkins, 210 feet west of the point where the three lenses unite and again branch off, a drift has been driven 75 feet west with the heading still in ore, and beyond it a large amount of unexplored ground through which it is believed the Perkins vein passes to a connection with the large and seemingly isolated deposits west of No. 5 shaft. Having explored the workings east of No. 3 shaft, together with the western extension of the Per-

kins just alluded to, we enter a drift and go west 40 feet, north 30 feet, and north-east 90 feet, to where an opening has been made in a comparatively small body of ore; we then continue along 25 feet north-west and emerge into an open pit 45x60 feet in size with some ore remaining in the bottom; thence 315 feet north and west into No. 4, where a large chamber has been worked out, the ore showing on all sides and in the bottom, the width between well-defined walls being by actual measurement 87 feet. The floor of this chamber is apparently all clean ore, while there are high stopes the whole width of the formation, looking both east and west. From No. 4 we go through a drift 85 feet south-west, and thence 90 feet north-west into No. 5, where another large room has been mined out, but in which the ground is considerably broken. The ore from this pit is raised through No. 5 shaft, which is located in the foot-wall with a cross-cut of 15 feet from the bottom, on the 2d level. The shaft is now on its way down to the 3d level. It should be remembered that in reaching this point from No. 1 shaft we have been gradually ascending the hill, the elevation of which at No. 5 is at least 50 feet above Nos. 1 and 2, while the shaft itself is one lift less in depth than the latter measuring from the collar of each, and making no allowance for difference in surface elevation. This fact will account for the broken character of the formation in No. 5, the workings of which are in ground that appears to have been distorted by unusual disturbance. The indications are that more settled ground will be reached at a depth corresponding with the present lowest levels in the east end of the mine, though it is probable that a fold in the formation throws the ore over some distance to the south. This last theory is corroborated by the fact that two drifts west and south, 35 and 70, and 80 and 70 feet, respectively, struck the limestone, which at all other points in the mine is the underlying rock.

Going back to No. 5 and up the ladder to the surface, we pass along 130 feet west to the skip-road in No. 6; this is a very large open pit, the floor of which is apparently all ore, the distance between walls being 120 feet, with the ore making rapidly under the hanging. There would seem to be a very large body of ore at this point, but, if the fold theory is correct, it is probably also a pocket; the drift last mentioned struck the limestone to the south of this pit, though at some depth below the bottom.

No. 7 is 110 feet further west and does not show much ore. A drift from the bottom of this pit was driven north through soapstone, and struck the limestone at a distance of 45 feet—95 feet above the level on which it was encountered in the drifts south and east—a fact which further suggests the fold theory as being the correct one.

No. 8, 180 feet further west, is a large open cut, in the west end of which there is a stop 60 feet high and 110 feet wide. A close examination of this stope revealed but one trifling wedge of rock, the balance, as well as the entire bottom of the pit, being apparently all clean ore. Clambering up over the top of this stope we enter No. 9, the east end of which is an open cut, with the underground workings extending 180 feet further west. There is here a run of ore, as shown by the workings, 200 feet long, and at least 40 feet wide, with a drift from the west end 175 feet along the foot-wall, all the way, and still continuing in ore. This drift will be continued 200 feet further west to a connection with a new working shaft now down 100 feet, and 100 feet east of which the diamond drill struck ore of the same quality. Still another working shaft will strike the drift 65 feet west of the most westerly stope.

Altogether the Norway is in a most excellent condition for large and economical production. An examination of the workings will cause a person to wonder, not at the large output of the last two years, but how it will be possible to keep the production down to the estimate for the present year—140,000 tons. Shipments commenced from surface stock-piles aggregating nearly, if not quite, 50,000 tons, while the visitor to the underground workings is obliged to clamber over numerous piles of ore broken and ready to be trammed out to the skip whenever wanted. In one place, where an entire level of 60 feet had been taken down by a back-stope, the ore has been left where it fell, forming a stock-pile 50 feet high and containing nearly, if not quite, 10,000 tons. Capt. Oliver, who is in charge of the mine work, can see no utility in raising to the surface ore mined in the winter for which he can find room underground, and thus save to his company the cost of re-handling from the stock-piles to the cars. He is exceedingly conservative in his estimates, and will need to be considerably so in other respects if, with the reserve he has to draw upon, he raises no more ore this year than he has promised. In the writer's opin-

ion he might have promised much more, and yet remained on the safe side.

Among the other improvements and additions made since our last annual review is a new stone engine and compressor house near No. 5 shaft, in which has been placed two boilers $4\frac{1}{2} \times 16$ feet, one of Rand's compressors with $16\frac{1}{2} \times 30$ steam and air cylinders, and one of Merritt's 12×24 engines. The latter operates a 12-inch Cornish plunger in No. 5, and the compressor furnishes the power for 7 Ingersoll power drills. The plunger was all made at the company's own shops. This, together with a new duplex 8×12 Rochester engine with 4-foot drum in No. 4 engine house, constitutes all the new machinery added the past year. The machine shop is the largest and best equipped of any on the range.

A miners' hall and reading room is a most commendable feature at this location, and one which might be copied with advantage at all the large mines in the upper peninsula. The building, a very neat and commodious two-story structure, was built and presented to the miners' club by the company. The hall is leased to the Odd Fellows and Temple of Honor, the rents being devoted to the purchase of books and periodicals for the reading room.

The Norway gives employment to about 450 men, and, notwithstanding Capt. Oliver's estimate, can safely be relied upon, if necessary, for a largely increased product, as compared with the output of 1881.

THE CYCLOPS MINE

is in a fair way to recover the ground lost in the past two years, a new and apparently most important discovery having recently been made, and which is relied on for the larger part of this year's product. It will be remembered that the original opening at the Cyclops was made in the south-eastern slope of the hill which forms the north-western background of the village of Norway, and that the deposit, though promising well in the beginning, was well nigh exhausted at a depth of not much more than 50 feet. Some little distance east of this open pit the trend of the formation curves around from east to north-east. Near this point a shaft was sunk some two years ago, from the bottom of which an underground stope was begun and carried west to the open pit; but here, too, the ore was to all

appearances exhausted. Recently, Capt. Oliver, who is so good a miner that he has been given sole charge of the Cyclops and Norway, as mining captain—the services of a superintendent not being considered necessary—set a couple of experienced miners to work scrambling in this underground pit, when it was soon discovered that what the former mining captain had conceived to be a regular foot-wall, was, in fact, a thin shale of rock, which hid from view what now appears to be a very large body of clean blue ore. This deposit is capped over by a heavy layer of horizontally bedded sandstone, enough of which, at the time of the writer's visit, (May 16), had been removed to expose, together with a drift into the foot-wall side, a deposit of ore at least 50 feet in width, and extending it is not known how far to the west and north-east. It is certainly the most promising discovery yet made on the Cyclops tract, and one which will, we think, give to the mine a permanency which it has never hitherto possessed.

In the old original pit the ore has pinched out to 4 feet in the bottom, and unless an improvement occurs very soon it will be permanently abandoned. North-west of No. 1, and well up towards the summit of the hill, is No. 5, where a shaft is down 65 feet in what Capt. Oliver calls a "boil" of ore and rock. The ore is good, what there is of it, but the rock appears to predominate. From the bottom of this pit a drift has been driven 20 feet north into the foot-wall, encountering two or three small veins or leaders in its course. The probability is that these come together further down, to test which theory it is proposed to put a diamond drill hole in from the bottom of No. 1, and thus cut the same formation 150 feet below the drift referred to.

No. 4, which is from 100 to 200 feet west of No. 5, and still higher up the hill, is down 100 feet, with the shaft in 10 feet of clean ore. But little ground has been opened up at this point, however, and the extent of the deposit has by no means been definitely ascertained. An exploration shaft is going down still further to the west, with good indications, but so far has developed nothing of value. The chief reliance of the management is on the new discovery referred to, and without which there would be little to write about, or even to hang a sanguine hope upon in connection with the Cyclops.

The annual output of the Cyclops has been :

	<i>Gross Tons.</i>
1878.....	6,028
1879.....	46,158
1880.....	14,368
1881.....	12,644
Total.....	79,198

If there should be no further decrease in product this year, it will be solely due to the rapid development of the new discovery in which active mine work will soon be commenced; the product will probably be somewhat below that of last year. The mine gives employment to about 35 men.

THE INDIANA MINE

is in the north half of the north-east quarter of section-27, town 40, range 30, about one and a half miles due north of the village of Quinnesec. It is the property in leasehold of the Indiana Iron Company, officered as follows:

President—JOHN A. KRUSE;

Treasurer—D. W. IRWIN;

Secretary—R. C. FLANNIGAN;

General Manager—R. P. TRAVERS.

Work was commenced on the west forty of the company's tract sometime in 1880, in an outcrop of lean ore or banded ore and slates, but nothing of absolute value was found till early in the following year. An exploration shaft just south of the banded ore formation struck clean blue ore, which, at a depth of 45 feet, appeared to carry a width of something over 20 feet. In sinking further, however, the foot-wall came in very rapidly and seemingly narrowed the lens down to a small compass. A drift east from this shaft was made on the 45-foot level, and along what appeared to be the foot-wall, 100 feet in ore, where a second shaft was raised to the surface. At this point the ore was found to be covered by only a few feet of drift. This second shaft was then carried down 50 feet further, and, as at No. 1, the rock appeared to come in from the foot-wall and either cut the ore out or else shoved it abruptly over into the hanging. An examination of the pits shows that some questionable work was done, the lower part of No. 2 shaft having been run on an incline which took it away from the ore. Since then what was supposed to be a bulge in the foot-wall proves to be merely a thin strip of rock under which the ore is again found in a large body. There is, in fact, a very large show of ore

on the bottom level, where actual measurement gives 35 to 40 feet between walls, with the foot going down nearly perpendicular, and the ore still making rapidly under the hanging. A winze, on the foot-wall side, is down some 15 feet below the bottom, in ore of the very best quality, and there is no longer any room to doubt the existence of a very large deposit at this point. The mine is even now in shape to mine and hoist 100 tons a day, there being at least 10,000 tons of it in plain sight. The trend of the formation is due east and west, the ore dipping to the south and having an easterly pitch. The ore itself is of uniform first-class quality. An average analysis recently made shows it to carry 69.3 per cent. of metallic iron—or within a fraction of the maximum—silica .45 per cent., and barely a trace of phosphorus, thus establishing its claim to a front place among the most valuable ores of the district. The deposit undoubtedly belongs to the Chapin belt, the formation in which it is found being traceable all the way through sections 28 and 29 to a point near the Chapin mine.

East of No. 2 shaft, several test pits are down in ore of the same good quality, showing a run of ore at least 500 feet in length, and still continuing to the east. A union shaft is being put down on the east line, at the joint expense of the Indiana and Illinois companies, but this, we think, is too far north to strike the ore except by drifting south from its bottom.

The mine will be supplied with shipping facilities by a branch line of the Chicago & Northwestern, which leaves the main line half a mile east of Quinnesec, and which is now ready for the ties and rails. It will probably be ironed in time to enable the mine to commence shipments not later than the middle of July, from stock-piles which will probably aggregate not less than 5,000 tons. Only so much ore is now being raised—about 40 tons daily—as must necessarily be taken out in preparing for active mine work when the product can be transferred direct from the skip into the railway cars. A skip-road in No. 2 shaft is operated by a Rochester engine with a 4-foot drum, while the pockets are up and nothing is now needed to start the Indiana on a most prosperous career, save the completion of the branch railway. Work will be resumed in No. 1 at an early day, and we predict for the Indiana an output in excess of 10,000 tons the present year.

THE QUINNESEC MINE

is one of the oldest mines on the Menominee range, though one year younger than the Vulcan, taking the first shipment as the basis in the computation of age. From the commencement the annual output has been as follows:

	<i>Gross Tons.</i>
1878.....	25,925
1879.....	41,954
1880.....	52,436
1881.....	43,711

Total.....	164,026
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It will be noticed that there was a falling off of nearly 9,000 tons last year, as compared with the product of 1880, which is accounted for by the fact stated in our last annual review, that the lens in which the workings are located is gradually being contracted by the crossings of rock at the east and west ends. To what extent this contraction is affecting the productive capacity of the mine may be inferred from the fact that the lens has lost 33 feet in length, at the east end, in sinking one lift from the 7th to the 8th level, the pitch of the rock-crossings being east and west toward each other, and threatening to cut the ore out altogether. These crossings, however, have never been cut through, and it is not improbable that other lenses will ultimately be found to take the place of the one now threatened with exhaustion.

Since our last annual review the numbers of the skip shafts have been rearranged, No. 1 now being the most easterly, and 2, 3, and 4 following in consecutive order going west. The levels have also been changed, the 1st having been abandoned, and those below it being numbered from 1 to 8 consecutively. Nos. 1 and 2 shafts are now down about 500 feet to the 8th level; No. 3 rests at the 7th, and No. 4 at the 3rd level. From No. 1 to No. 2, on the 6th level, the ore body was from 10 to 30 feet thick, while on the 8th level drifting is in progress from No. 1 shaft west, in not more than 6 feet of ore, which it is thought, however, will widen out going toward No. 2. At No. 2 there is apparently a very large body of ore in the lower levels, while at No. 3 the lens is not more than 8 feet thick. Nos. 1, 2 and 3 are connected by drifts on the 7th and 8th levels, with all the ground between the 6th and 8th yet standing. From the east end a drift was driven 30 feet east in soapstone, from the outer end of which a cross-cut 40 feet south encoun-

tered nothing but lean ore and jasper. A similar drift and cross-cut west of No. 4 was productive of no better results. It would seem as if both these drifts ought to be continued until the end of the soapstone is reached, in order to ascertain what there is beyond it. There is, however, a large amount of ore yet remaining in the mine as at present opened; that new lenses will be discovered when the management gathers up sufficient pluck to break through the enclosing rock, is altogether probable. Indeed, explorations now in progress not only promise well, but threaten the complete overthrow of the theory that the limestone holds the age, geologically speaking, and that it must necessarily underlie the ore. About 1,000 feet north of the old works, and 300 feet beyond an out-cropping of limestone, a shaft was, at the time of the writer's visit, down some 35 feet in ore and sandstone, with most excellent indications that the bottom was near a deposit of clean ore. It is barely possible that the presence of ore at this point may be correctly accounted for on a theory of a fold in the limestone, but the lay of the ground, and what can be seen of the general formation, does not encourage such a belief. On the other hand, 400 feet south of the old workings, a shaft is sinking in red slates, in which there is considerable red ore of apparent good quality, though entirely different from any other found on the location. Here, too, the indications are strongly in favor of the existence of a body of clean ore in the near vicinity. The regular foot-wall slates are found 1,000 feet east and north of the present workings, and it is proposed to now thoroughly explore the ground in that direction with a diamond drill and otherwise. Notwithstanding, therefore, the somewhat discouraging outlook on the main workings, there is, nevertheless, much upon which to base large hopes for the Quinnesec in the future. But a small portion of the tract has yet been explored, and in her case a failure to find other, and perhaps larger, lenses than those embraced in the original discovery would be indeed an exceptional case in the history of iron mining on the upper peninsula.

There was mined and raised during the past winter about 22,000 tons, and with two levels opened ahead the writer can see no good reason why the product of 1881 should not be improved upon. No new machinery has been added during the past year, though the engine house was destroyed by fire in July, and was replaced with a new one, 30x70, which was erected and

the machinery repaired and again set in motion in the short space of 17 days. The mine furnishes employment to a force of about 250 men, with Capt. Elisha Morcom still exercising the most efficient supervision of mining operations.

THE KEEL RIDGE MINE

presents some new features, all of an encouraging character. A new double shaft, with upright self-pumping balance skip-road, has taken the place of old No. 2, and through it the entire product of the mine is raised to the surface. This shaft is now down 220 feet from the collar to the present working level, which last is being prepared for stopping. This winze is located 30 feet east of the shaft, under which last a drift from the winze is in rock—the shaft itself having been sunk all the way in rock, except the last lift of 60 feet. The occurrence of the same kind of rock 60 feet below the bottom of the shaft, however, indicates nothing more than a probable change of dip or a mere bulge in the foot-wall. The wedge of rock, as well as the vein of red ore, has cut out altogether on the present working level, and there is now nothing but clean blue ore of the finest quality between the walls, if we except the rock under the bottom of the shaft, the relation of which to the ore body has not yet been determined. The dip is so nearly vertical that it is a question which is the foot, and which the hanging-wall—the ore now making rapidly under what was last year regarded as the foot-wall and transforming it into the hanging. The underground workings cover a length of 276 feet, the ore body being lens-shaped and narrowing down to a point in the east, and being cut squarely off by a horse or crossing of rock at the point of its greatest width, at the west end. East of the shaft, which is located a little to the east of the center of the workings, the ore body varies from 8 to 15 feet in thickness, while on the west side it averages not less than 40 feet. The lens, if such it can properly be termed, is what the miners call a “chimney,” which was only 20 feet in length at the top, the ore appearing to pitch both east and west from the center, so that it lengthens out rapidly in sinking. On the lower level the rock has, however, shoved in a little at the west end. The rock crossing at the west end has never been cut through, but a shaft was sunk 270 feet west of the skip, and from it holes bored north and south, and

nothing found but mixed ore and rock ; so there is little promise of an extension of the ore body in that direction, though it is possible that the borings may not have cut the formation at a sufficient depth to settle that question conclusively. As it is, however, the mine presents a much more promising outlook than at this time last year, the ore body having gained very considerably, both in length and breadth, in sinking a single lift of 60 feet. The mine is being wrought on the modified Nevada plan, in rooms 20 feet wide, leaving alternate pillars of ore 15 feet thick. The double shaft and skip-road is a most perfect piece of work, and we believe the only one of its kind in the region.

Since work was commenced the annual product of the Keel Ridge has been as follows :

	<i>Gross Tons.</i>
1880.....	11,496
1881.....	19,011
Total.....	30,507

The mine is owned and wrought by the Emmett Mining Co., E. P. Foster being general agent, and J. T. Jones superintendent, with Capt. John Wicks in charge of the underground work. The plant of machinery consists of two Rochester duplex engines of the largest size, with two 6-foot drums, and six 30-inch Fraser & Chalmers drums, which last are used for sinking and drifting. About 11,000 tons was raised during the winter months, and the chances are that a product of not less than 40,000 tons will be achieved the present year. The mine gives employment to a force of about 120 men.

THE CHAPIN MINE,

"It's no use talking," remarked a friend to the writer not long ago, "that Chapin mine lays way over any other in the upper peninsula or anywhere else." "What can be said or written of a mine so abundantly able to talk for itself?" was the mental inquiry of the writer, as he ascended the ladders after a careful inspection of the Chapin a few days since (May 30). We have some large mines in the upper peninsula, and particularly in Marquette county—single mines from whose deposits millions of tons of ore have been taken, and which are apparently good for millions more—but not one of them approaches the Chapin in magnitude of deposit, or in the sure

promise of enormous production in the future. "See Rome and die!" was centuries ago the voluntary advice with which some one, not so celebrated but that we have forgotten his name, gave laconic expression to his appreciation of the art treasures and glory of the Eternal City, throned in majesty upon her seven hills; see the Chapin mine, and the chances are that you will die without ever seeing its like elsewhere, even though you visit all the iron mines in the universe. It is simply immense in its proportions, and greater yet in its possibilities, nay, probabilities, of future development. If he were to consult his own peculiar notion in the premises, the writer would simply post the Chapin as the "boss" iron mine of the world, and leave to Time the task of proving the truth of his assertion. He would do this for the reason that his powers of description fail, or rather are certain to subject him to opposing accusations of untruthfulness—he cannot draw the picture large enough to please those who have seen the mine lately, while those who have not will be certain to charge him with exaggeration. Some idea of the extent of the deposit may be inferred from the fact that it is now opened up over a length of 2,350 feet, and that over this great length the ore body carries a width varying from 30 feet in the narrowest place to 127 feet at the widest—the largest and most uniformly clean deposit ever yet developed in the upper peninsula. We give here the approximate size of the ore body, as shown by the workings; when it is stated that the ore still continues in both the east and west ends, with the new Ludington 1,320 feet distant and in direct line with the trend of the Chapin formation, and about 300 feet remaining to be opened up in the east end to the Walpole line, what the large probabilities for the future are may readily be inferred. The formation, which at first appeared to have a nearly east and west trend, swings around to the north-east near where the break spoken of in our last annual review occurs, and to the north-west in going in an opposite direction from the same point—the original and most easterly workings being close up to the line between sections 30 and 31, and the most westerly shaft 450 feet north of it. The developments at the Ludington, a quarter of a mile further west, taking it for granted that they are in the same ore body, indicate a still sharper curve to the north-west, and rather tends to corroborate the theory which has been advanced, that we have here a huge ore basin similar

to that at Ishpeming. But for the undetermined age of the limestone formation, an outcrop of which occurs not far to the north of the Chapin workings, the basin theory would be by far the most plausible, and we are inclined to give it the preference, as it is. The same foot-wall slates occur at the Cornell, which is north of the limestone, and where the dip is to the south. The curves at the east and west ends of the Chapin indicate that the deposit, whether the upturned rim of a basin, as suggested, or otherwise, conforms somewhat to the topography of the immediate locality, and skirts the base of the hills which look over against each other east and west.

It will be remembered that the ore body, as stated in our last annual review, was cut off by a crossing of rock at No. 3. Afterwards a point of rock came in about 100 feet west of No. 3, and appeared to split the vein, which continued west on either side of it. It is probable, however, that they come together again some distance further on, where they form the immense body of ore referred to, and where the distance between walls is 127 feet by actual measurement; the north vein, or branch, of the deposit has not been followed a sufficient length to settle the point definitely. Capt. Rundle, rightly arguing, as subsequent developments proved, that there was a break in the formation at No. 3, caused a drift to be driven north from the bottom of No. 4 shaft on the 2d level; this drift, after passing through 45 feet of soapstone, struck clean blue ore in which it continued 60 feet. A similar drift on the level above cut 50 feet of rock and 20 feet of ore, when it encountered mixed ore and jasper, which last, however, presents none of the characteristics of a regular hanging-wall. On the 3rd level a cross-cut shows 130 feet of ore and only 10 feet of rock, while another from No. 2, 190 feet east of No. 4, on the 2d level, cut through 180 feet of mixed ore and jasper into clean ore. North-east of the outer end of this last mentioned drift, 225 feet, a shaft is down 110 feet, from the bottom of which drifting is in progress to a connection with the drift, shaft and drift both being in ore. A drift is also in progress eastward from the shaft, and at the time of the writer's visit was 70 feet in ore. In giving a general statement of the size of the deposit, the ore body east of the crossing in No. 3, where the original openings were made, is not included, reference being had only to that part of the ore body the width of which has been positively determined.

Since our last report the workings have been extended westward, and two new shafts have been put down, 325 and 190 feet, respectively, west of No. 8; these new shafts are numbered 9 and 10. All the other shafts—3 to 8, inclusive—except No. 4, are down to the 4th level, the last lift being 100 feet. No. 4, which is a timber shaft, will likewise be carried down to the 4th, on which drifting is now in progress to connect the several shafts and prepare the ground for stoping. In the meantime a whole summer's work remains above the 3rd level as far west as No. 8, while west of that most of the 2d level remains unbroken, though the shafts are down to the 3rd. About 50 feet west of No. 8 is the only chamber worked out the whole width, and which shows the vein to be 127 feet wide; beyond that it has not been cross-cut, but there is every reason to believe that it will lose none of its majestic proportions in going west 1,320 to the new Ludington, where a cross-cut shows 70 feet of ore without exposing either wall.

The system of timbering—a modification of the Nevada system—which at the date of our last report was regarded in some quarters as a doubtful experiment, works admirably, though we believe the real Nevada system would be a great improvement. The only fear of failure was in the matter of successfully catching the timbers of the bottom sets with those coming up from the next below, but this has been done in every instance. We believe that by adopting the true Nevada system the ore can be mined out clean between the walls, if it is desirable that that shall be done; but in any event, it would be an improvement, in that the timbers can be handled with greater ease and facility, while at the same time the miners will be as well, if not better, protected against a "run" of ground. However this may be, we feel assured that Capt. Rundle, who is a man of progressive ideas, will give the matter due consideration, and not allow the fact that he was the originator of his present excellent system of timbering to prejudice him against the adoption of one of which his is simply a modification, if it shall prove better adapted to the successful working of his mine.

Great surface changes and improvements have been made at the Chapin the past year. Among these are new and extensive trestle-works—one of which, from Nos. 3 and 5 to the new pockets near the office, is 800 feet long and 65 feet high at the outer end; one extending from No. 3 to the new saw-mill, and which

is used for conveying timber and wood to the shafts and engine houses, is 2,400 feet in length, and another, from No. 7 to the railway side-track, which is 350 feet long, with a dump of 50 feet—all operated by means of an endless wire rope, propelled by a 12x18 engine. Another from No. 9 to a new spur track is now in course of erection, and will be 250 feet in length. The saw-mill referred to was built for the express purpose of sawing and preparing timber and plank for the mine. A new hospital, reading room, and two churches—Methodist and Swedish Lutheran—are among the new buildings. A 14x26 engine, four 30-inch and six 4-foot drums have been added to the mine equipment.

The mine gives employment to about 900 men, 500 of whom are miners. Shipments commenced this year from stock-piles aggregating 100,000 tons, and the daily average product at the present time is about 800 tons. The shipments from the Chapin were 34,556 tons in 1880, and 134,521 last year—a total of 169,077 tons. Capt. Rundle talks about a product of 200,000 tons; but how he will manage to keep within those limits the writer will be curious enough to inquire at the close of the season.

THE LUDINGTON MINE

is the property of the Lumbermen's Mining Company, which until recently had been rather unfortunate in its operations, having lost, or exhausted, the ore at the Stephenson, and spent considerable money in trying to find the deposit on section 9, now being wrought by the Brier Hill Company, while the Ludington had likewise come to be regarded as a signal failure. This last named mine is in the south half of section 25, town 40, range 31, and immediately adjoins the Chapin on the west. Work was originally commenced and carried on in a small lens about half a mile west of the Chapin line, which at one time gave promise of developing into a mine of permanent value. but which was completely exhausted the second year after being opened, the shipments from it having been as follows:

	Gross Tons.
1880.....	8,816
1881.....	3,374
Total.....	12,190

Then followed a systematic and thorough exploration of the company's tract, which was perforated in every direction with

diamond drill holes without favorable result, until the last available piece of ground was reached, and that being north of the apparent trend of the Chapin belt, was attacked with little hope of successful issue. Here, near the north-east corner of the Chapin tract, the drill struck clean blue ore, into which a shaft, at the time of the writer's visit, had been sunk 45 feet. From the bottom of this shaft, which is 100 feet west of the Chapin line, a drift south passed through 48 feet of clean ore to the foot wall, which is a mixed ore and jasper conformable to the lean ore foot-wall formation of the Chapin. A drift was likewise being driven west from this shaft, in ore. West of this shaft a large area of ore has been exposed by the removal of the drift covering, while from the bottom of a shaft which is 30 feet in ore, drifts north and south show 70 feet of clean ore without exposing either foot or hanging. This No. 2 shaft is 250 feet west of No. 1, while the stripping still further west shows a continuous run of ore 500 feet in length, measuring from the Chapin line, with which belt it is undoubtedly continuous. A third shaft is going down still further to the west, but being evidently in the foot-wall the writer is at a loss to understand what purpose it is intended to subserve. The ore body will, he thinks, be found to swing round the base of the hill to the north, a belief which is strengthened by the very evident fact that the shaft last mentioned, though directly west of No. 2, is going down in rock which conforms in all respects to the mixed ore lying south of the Chapin, as well as with that struck by the drift south from No. 1. Let this be as it may, however, unless the ore pinches out entirely within a short distance, in whichever direction it may extend beyond the present workings, the Ludington will certainly take rank as one of the largest mines on the range. A lens of ore 500 feet long and from 50 to 75 feet wide, will in itself constitute a large mine—that the new Ludington has these dimensions is certain, while there is every reason to believe that the ore already exposed includes but a small portion of the deposit. The mine is being opened in a systematic manner. A new plant of machinery, consisting of three duplex Rochester engines, with 5-foot drums, is in place, and every preparation is in progress for working the mine on a large scale. Geo. E. Stockbridge is superintendent, and Wm. Bice mining captain.

* *

Close by the new Ludington, the dip of which is to the north,

on the west line of section 30—40—30, the Emmett Mining Company is putting down a diamond drill hole, with the confident expectation of cutting the vein. That the hope in this direction will be realized is very probable, especially if, as the writer believes, the Ludington vein makes a sharp curve to the north just beyond the present workings.

THE HEWITT MINE,

what there is of it, is in the lean ore formation, immediately on the line between sections 30 and 31, at the east end and south of the Chapin, the original pit of the latter having been started on what is now the Hewitt. In other words, the east end of the Chapin—or rather the thin spur of ore extending a little south of east from where the main ore body makes to the north—crosses the Hewitt line, though the dip carries it back again upon the Chapin at no very considerable depth. The ore shipped by the Hewitt last year was mined out from this lens, above the Chapin line, and most of that being shipped the present season comes from the Chapin stock piles, under an arrangement by which the Hewitt relinquished its claim to the remaining part of the Chapin vein above the line between the two properties, in consideration for 3,000 tons of Chapin ore, delivered on the cars. The mine, therefore, now consists of a small lens of ore, which was struck in drifting south some 200 feet, and from which scarcely enough ore is being mined to cover the expense. Unless something better is found, the Hewitt will not long hold a place in the list of shipping mines.

THE COMMONWEALTH MINE

is in Wisconsin, and is the property in fee simple of the Commonwealth Iron Company, whose entire estate embraces some 3,000 acres, its mines being located in sections 35 and 32, town 40, range 18, east. The work of development was begun in the spring of 1880, since which time the shipments have been as follows:

	<i>Gross Tons.</i>
1880.....	9,643
1881.....	97,410
Total.....	107,053

A considerable change in the appearance of the workings has taken place since the publication of our last annual review. These workings now consist of four open pits, the main one of which, the Taylor, was the only one being wrought a year ago,

at which time it was 48 feet wide, 204 feet long, and 50 feet deep. Since then it has been extended to a length of about 300 feet, and worked out on the foot-wall side to a depth of 124 feet, leaving a stope at least 50 feet high extending along the whole length of the pit from east to west, the ground thus remaining to be broken carrying an average width, we should say, of not more than 40 feet. In the east and west ends of this pit there are splits in the ore body, the heavy bodies of rock left standing giving it the appearance of a huge pocket, but at the west end one branch of the deposit seems to swing off to the north-west, while another passes to the south of the wedge of rock, and widens out to 45 feet a short distance further on. Both these branch veins or lenses are capped over with rock, that on the north being about 12 feet thick, and appearing to grow wider in the bottom. In the east end a narrow run of ore connects with No. 5 pit, which is 80 feet deep, and like the Taylor presents the appearance of a pocket, though of much smaller dimensions. It is probably a mere spur of the main ore body, which it is believed swings round to the north-east, the ground to the east of No. 5 having been thoroughly tested with the drill, and found barren to a depth of 140 feet. A trench 350 feet east, however, shows what might be called good prospecting ground. At present the diamond drill is boring at an angle of 48 degrees to the south, from a point 400 feet north-east of the Taylor pit, in which direction it is believed an extension of the main ore body, or another and separate lens will be found. It is the intention to bore this hole to a depth of at least 500 feet on the angle stated, in order to fully determine the character of the formation.

A short distance west of the Taylor is the Noall pit, in which, however, there is not much ore to be seen, while 200 feet west and south is the Luke pit, which appears to be in a distinct and separate lens, having, so far as known, no connection with either of the others. The Noall pit is from 75 to 100 feet long, 50 feet wide, and 90 feet deep, the lens narrowing down from about 50 feet in the center to a point at either end.

The Little Commonwealth, so-called, is in section 32, about $2\frac{1}{2}$ miles west of the main workings, and promises to develop into something of more than ordinary value. The vein has been opened up by trenches and test pits over a length of about 1,100 feet, and seems to average about 20 feet in width, grad-

ually growing wider going west. It will be remembered that mention was made in our last annual review of a shaft having been sunk to a depth of 68 feet in this vein, from which some 500 tons of ore was mined, the ore closely resembling the Champion magnetic, though giving a red powder. This ore analyzes 65 per cent., and there being a large body of it, we may confidently expect ere long to see it developed into a valuable mining property. Many new and important improvements have been made at the Commonwealth the past year, among them some large and costly buildings. Two new skip-roads have been put in, while to the machinery equipment has been added three duplex Rochester engines with 4-foot drums, one portable hoisting engine with 20-inch drum, one Burleigh air compressor, and one 9 and two No. 6 Knowles plunger pumps. The side-tracks, docks, pockets, etc., are most admirably arranged, and everything about the mine gives evidence of a most careful and attentive management. The usual mining force numbers about 400 men, but since the inauguration of the strikes at the great iron centers the force has been largely reduced in anticipation of a declining market. The present force is raising about 10,000 tons per month, which, together with the amount already shipped and in stock, will suffice to fill all existing contracts for this season's delivery.

In May the product was 14,000 tons, and if it had been necessary a monthly product of 17,000 tons could have been maintained throughout the season of navigation. H. A. Tuttle, of Cleveland, Ohio, retains the position of general manager, and Capt. W. E. Dickinson is superintendent.

THE FLORENCE MINE,

which is also in Wisconsin, has developed wonderfully during the past year. A large amount of new ground has been opened up to the west of the workings as they existed at the date of our last annual review, while many surface improvements of a permanent and most substantial character have been made. An interest in the property was sold last fall to eastern parties, and the mine is now owned and operated by the Florence Mining Company. Since the first shipment was made, less than two years ago, the output has been as follows:

	<i>Gross Tons.</i>
1880.....	14,148
1881.....	100,501
Total.....	114,649

The mine is now being wrought on the underground plan, in lifts of 80 feet, leaving a roof of 20 feet for the support of the walls, which gives stopes 60 feet in height. Work is now in progress on the 2d level, where there are some very large stopes, the ore from which is now, or soon will be, raised on two skip-roads in as many shafts numbered 1 and 2; heretofore only steam derricks and buckets have been employed. It is hardly necessary to attempt any description of the workings further than to say that the total length now open on the upper level, independent of some poor ground in the east end, is 494 feet, while it is 113 feet from the west end to No. 3 shaft, now down in ore; the greatest width between walls is 90 feet, while the average over the whole distance is 66 feet. From No. 4, the most westerly of the underground pits, there is a stretch of rich specular ore concerning which the management is very hopeful, notwithstanding its width is not yet known. No. 4 shaft is 650 feet north-west of No. 3, and is down to the ore ledge; it looks well, but the ground is very wet, and not enough work has yet been done to test the extent of the deposit at that point. The ore has been found still further to the north-west, the vein really commencing west of the old original open pit, and being determined a distance of 1,286 feet north-west from that point. In the east end of the open pit poor ground was encountered, not only in the bottom, but in a drift 78 feet in length, all in mixed ore. From this open pit a drift north-east into the hanging cut 21 feet of mixed and 8 feet of clean ore, and at the time of the writer's visit had gone 127 feet into very hard graphite. It was proposed to continue this drift until the graphite was gone through, so as to fully determine what there might be beyond it. From the dimensions stated it will be observed that the workings have been extended a very considerable distance north-west; it is also noticeable that while there is very much more ore in sight than was to be seen a year ago, the quality has likewise improved to such an extent as to bring it within the standard of first-class in every respect save as to phosphorus. Going west a very rich looking red ore is found, in addition to the specular belt mentioned as extending from the west pit to No. 3 shaft, the phosphorus mainly occurring in the yellow ochre lying next to the hanging. We think a mistake is made in not mining these ores separately, as might be done, considering the fact that mixing the yellow

ochre with others not only lessens the average of metallic iron in the whole, but very materially increases the amount of phosphorus. At the time of the writer's visit an effort was making to eliminate the yellow ochre mixed with and clinging to the better ore by washing, but, we thought, with indifferent success; it would be better and cheaper to mine them separately in the first place. Some small horses of rock occur in the workings, but the ore body is in the main uniformly clean, and but little selection is necessary. The mine is a large one, capable of a much larger output than will be achieved this year, for the reason that for some months the work has been principally confined to sinking, putting in skip-roads, and otherwise perfecting the change from open pit to underground mining. This change fully effected, the mine will be in a condition to very materially increase her product, though an output of from 125,000 to 150,000 tons may be confidently anticipated the present year. Altogether, the writer was much pleased with the outlook at the Florence, a mine which certainly presents every indication of a large annual production for a long series of years to come.

The machinery embraces, in addition to that mentioned in our last annual review, two 3-foot Fraser & Chalmers drums, in the old engine-house, and two derricks; a new plant, located in a new engine house on the foot-wall side of the workings, near No. 3 shaft, which embraces one 20-inch Norwalk compressor, with 20x60 air reservoir, four No. 59 double cylinder 14x18 improved reversible link motion engines, with 5½-foot drums, of the Ledgewood make, one 5x8 and one 6½x8 Rochester double cylinder hoisting engines, the steam for which is furnished by a battery of four 5x16 boilers with 52 flues each. A second air compressor of the same make and size will shortly be added, while a 12-light 2,000-candle power Brush electric outfit, for lighting the mine, has just been set up, and is now in operation. Among the surface improvements are two high trestle-works, each 760 feet in length, extending from Nos. 1 and 2 shafts to new pockets over the railway track; these pockets are five in number, and have a capacity of 1,000 tons. Another similar trestle-work from No. 3 shaft to the same pockets will be built later in the season, the ore from that shaft in the meantime being moved over a tram road laid on the surface.

The mine gives employment to 350 men in all, 50 of whom are employed on the surface. The mine is under the able and efficient management of Alexander Kempt, Esq., superintendent, with Capt. Buddle, an experienced miner, in charge of the underground work.

THE ILLINOIS MINE

is located in the north-west quarter of section 26, town 40, range 30, the forty in which the workings are situated immediately adjoining the Indiana on the east. It is owned in leasehold by the Illinois Iron Company, made up principally of wealthy Chicagoans, Hon. Edward Breitung being owner of three-fourths of the fee and one-eighth of the lease, and president of the company. Some work of desultory character was done by an association styling itself the Scandia Iron Company, which subsequently sold out to parties who took a new option from the owners of the fee and organized the Illinois Iron Company, in whose behalf explorations have since been carried on spasmodically, and in anything rather than a systematic manner, though with very promising results. The old shaft commenced by the Scandia Company was put down by starts and jerks to a depth of about 100 feet, the last 70, except about 10 feet at the bottom, being in ore of good quality. This shaft has been carried down on the foot-wall, on which there is about 4 feet of soap-stone, which, together with 4 feet of ore, was taken out in sinking, the hanging-wall side showing ore all the way below the first 30 feet, with the exception of the 10 feet at the bottom, as stated. Here the foot-wall came in more rapidly, and the shaft was continued in rock, the ore being left in the hanging. From the bottom of this shaft a drift was started to cross-cut the formation, and struck ore in going a few feet, when the boiler, which had been the cause of all the vexatious delay, and ought to have been condemned in the start, gave completely out, and the shaft had to be abandoned until a new boiler could be procured. That has been done, and the work will now be resumed and pushed with vigor until the width of the deposit is determined. The ore bearing formation is an unusually wide one, and the probabilities are all in favor of a large deposit of clean ore. There can be but little doubt but that the Illinois is an eastern extension of the Indiana, the very great value of which has now

been proved, the deposit not only being a large one, but the ore as good as, if not better than, any other ever found in either of the great mining districts of the upper peninsula. The writer, owning an interest in the Illinois, might, perhaps, better leave unsaid any commendation of the property, but he is willing to submit the opinion herein expressed to the vindication which time will certainly bring. It is proper to say, however, that this opinion is corroborated by all the experienced mining men who have visited and inspected the location.

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Since the foregoing concerning the Indiana and Illinois mines was written ore of the same exceptional fine quality has been struck on the line between the two properties, where a shaft has been sunk to a depth of 100 feet. From the bottom of this shaft a drift south struck the ore at a distance of 60 feet, the south end of the drift being in direct line with the Indiana workings 1,000 feet to the west and No. 1 shaft of the Illinois about 600 feet to the east, thus showing the formation to be quite regular, and leaving very little room for doubt concerning the very great value of both properties. Indeed, this latest development would seem to insure to the Indiana a run of ore over 1,300 feet in length, while the distance from the union shaft to Illinois No. 1 is at least 600 feet, with every indication that the ore continues to the east and across the entire quarter section. The iron on the branch railway will have been laid and the first cargo of Indiana ore shipped before this meets the eye of the reader, and it is now reasonably certain that the Illinois will be added to the list of shipping mines before the end of the season.

THE CORNELL MINE,

after a total production of 42,557 tons in 1880-1, is lying idle, for what reason the writer has not been able to learn. It has been intimated that the idleness is occasioned by the exhaustion of the deposit; but we cannot learn that the lessees have surrendered their lease, as it seems they certainly would do if assured that the mine was worthless. Whatever the reason may be, the writer clings to the belief that the property is a valuable one, and that even though the ore may have been exhausted in the old workings, well directed explorations will reveal other and more durable lenses. Such has been the history of some of our best mines, which at one time or another were condemned as

worthless by faint-hearted owners or operators; notable among these are the mines of the Negaunee hematite range, which were years ago sold and re-sold for a mere song. Taking the worst stories as true, why may not the history of these mines be repeated in that of the Cornell?

THE MARYLAND MINE.

This is the old Breen mine under a new name and ownership, it now being the property, in leasehold, of the Maryland Iron Mining Company, the officers of which are:

President—C. L. ANDERSON;

Secretary—W. L. ROSS;

Superintendent—FRED. BECKSTROM.

It will be remembered that reference was made to this mine in the beginning of our paper on the Menominee range, which was written just about the time the new company began operations, and that extended mention was deferred until this time so as to enable us to give the result of the explorations not then more than fairly inaugurated. The writer regrets being compelled to say that when he visited the mine (June 29) he was unable to inspect the shafts and drifts west of and in the bottom of old No. 1 pit, owing to the fact that the pumps were out of order, and the workings full of water. He has it from what he deems good authority, however, that the new shaft is down something over 25 feet in ore, while the drift west from the old shaft is also in good ore. In the west pit, which is reached by a tunnel through the hanging, there is a good show of clean ore, though the ground is unsettled, and it is impossible to estimate with any degree of certainty the width of the lens. It looks, however, like a workable deposit, and we shall not be surprised if the old Breen should yet prove to be a valuable property. A little sinking and drifting in the bottom of this west pit will, we think, definitely settle the question.

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CRYSTAL FALLS DISTRICT.

At the close of our last annual review brief mention was made of new and important discoveries in towns 42 and 43, ranges 32 and 33, to which it was predicted the C. & N. W. R'y would be extended before the close of the year. This pre-

diction has been partially verified by the completion of the line from Florence to Crystal Falls, in section 20, town 43, range 32, and the survey of the Iron River branch, now being rapidly built to the Iron River and Nanaimo mines, in town 43, range 35. These new and promising ore fields are in the south-west part of Marquette county, so remote, however, from the so-called Marquette range, as to preclude the probability of their ever becoming identified with it, other than in a general way. Though the work of development was begun scarcely more than a year ago, there is now in the two new districts a population of several thousand people, two new townships—Crystal Falls and Iron River—have been organized, while two villages with the same names have sprung into existence, and are rapidly being built up and improved; and another called Stambaugh has been platted, and will doubtless grow to be an important town, being, as it is, contiguous to the prospectively largest mine in either of the new districts. The time will come, and is not far in the future, when this new region will demand and undoubtedly secure a separate county organization, with county seat at one of the new villages, all three of which are looking forward to that distinction.

The mines at and around Crystal Falls are the Crystal Falls, Youngstown, Fairbanks, Paint River, Union, Mastodon, Manhattan and Great Western, at some of which there are already considerable stock-piles from which to begin shipments as soon as the side-tracks are laid, while the others are in the first stages of development, if, indeed, they can properly be referred to other than as promising explorations. The first discovery of ore in this neighborhood was made years ago by Silas C. Smith, then a resident of Marquette, and by Col. Whittlesey, who makes mention of the discovery in some of his publications. The first practical discoveries, however, which led to the rapid development which has since followed, were made by John N. Armstrong, at what is now the Mastodon mine, and by Shelden & Schafer, at what is now the Union mine.

THE CRYSTAL FALLS MINE

is the joint property of the Crystal Falls Iron Company and of the Youngstown Iron Mining Company, and embraces lot 3—47 acres—in section 20, town 43, range 32. Theodore M. Davis was, until recently, the owner of the fee, which, however, he

lately sold to the companies named above for a consideration of \$80,000. The workings consist of a single shaft located on the west bank of the Paint river, immediately below the falls; this shaft is down 80 feet, with drifts from the bottom 25 and 30 feet, respectively, east and west. The west drift is all the way in slate, while the bottom of the one going east shows clean ore, with mixed ore in back and sides. From this shaft and drift about 1,500 tons of ore has been raised, some of which is very rich in metallic iron, and some rather below the standard of first-class. The stock-pile will need to be carefully picked over before shipping, and it does not seem probable that a very large mine can be developed, unless the deposit is found larger and more uniformly clean in sinking, which is altogether likely to be the case. The formation is a peculiar one, in that while the trend seems to be nearly due east and west, the slates which can be seen in the bed and on the east bank of the river, appear to cut off the ore in that direction, while it is similarly hedged in on the west. It is, however, yet too early to form a decided opinion as to the probable extent of the ore body, or even to write intelligently concerning the formation, which is, so far as can be seen, twisted and distorted in such a way as to puzzle the brain of a geologist very much better informed than we pretend to be in that science. Indeed, it may be truthfully said, that at none of the mines of these new districts has the work of development been carried far enough to enable or justify a person, however well posted he may be, to write anything other than of a general character concerning them.

At the time of the writer's visit (June 7) the side-track was being laid to the mine, and it was expected that the first shipment would be made the following week. The officers of the Crystal Falls Iron Company are:

President—N. K. FAIRBANKS;

Vice President—J. H. HOWE;

Sec. & Treas.—F. H. HEAD;

Superintendent—F. P. MILLS, JR.

THE FAIRBANKS MINE

is in the west half of the south-west quarter of section 21, town 43, range 32, and is the property in leasehold of the Crystal Falls Iron Company. The workings consist of one large open pit, from which, at the time of the writer's visit, nearly, if not

quite, 3,000 tons of ore had been mined. The ore is a soft reddish-brown hematite, rather lean and hungry looking, and in that regard very deceptive. A number of analyses shown us gave all the way from 55 to 66 per cent. of metallic iron, and it is claimed that the average is over 60. The trend of the formation is nearly east and west, and the dip apparently to the south. In the open pit referred to a horse of rock occurs near the center on the foot-wall side, but the ore appears to make round this horse, so that the width of the lens has not yet been determined; the occurrence of this horse gives the foot-wall the appearance of a sharp throw to the north, but we think further work will show the foot-wall to be quite regular. What appears to be a regular vein or lens of ore has been uncovered for a distance of over 100 feet east of the pit, while some 350 feet further along in the same direction a shaft is going down in the same formation, though we confess we could not discover much iron in what the miners called ore. There does not appear to be any good reason, however, to doubt that the deposit will be found continuous over the length stated, and probably for some distance further east; we speak only of the property as we saw it, and must not be understood as wishing in the least to disparage its value. It is a good showing for the work thus far done, and if the ore is as good as it is claimed to be, the development of a paying mine may be considered as well assured. The machinery consists of two 7x10 Rochester engines with 3-foot drums, which operate as many derricks. Work on the branch track, which leaves the main line at the Crystal Falls mine, is being pushed vigorously, and the mine will make her first shipment, most probably not later than August 1. With the amount which will be in stock by that time, the Fairbanks ought to be able to report a product of not less than 10,000 tons at the close of the season. J. H. Elmore, Esq., a most genial gentleman, is superintendent.

THE PAINT RIVER MINE

is in the east half of the south-east quarter of section 20, town 43, range 31, and adjoins the Fairbanks on the west. The tract is owned by Hon. Edward Breitung, but is under option; or lease, to the Paint River Iron Company, of which Max. Wineman, of Chicago, is president, and Joseph Austrian, of the same city, secretary and treasurer, they with Hon. Edward

Breitung, John McKenna and Dr. Bond constituting the board of directors. At the time of the writer's visit the best that could be said of this property was that there was a good chance for the development of a mine; a number of pits had been put down along the supposed course of the ore belt, and work was in progress in two shafts, but at that time nothing of positive value had been developed. One of these shafts, however, was located within 30 feet of the principal opening of the Fairbanks, and, as near as we could guess, the bottom was within a few feet of the ore, which it would be unreasonable to suppose could pinch out from a width of not less than 40 feet, in going so short a distance. We are informed that the ore has since been struck in this shaft, a fact not in the least surprising. The property is undoubtedly one of large promise, and its value, like that of others in the immediate vicinity, in our opinion, hinges more on the quality than quantity of the ore—of the latter we can form an estimate satisfactory to ourself; in the other case, the analyses shown us, and which are the better evidence, contradict what would otherwise be an honest opinion based on the outward appearance of the ore. It is not probable, either, that those interested would persist in spending large sums of money in the development of ore beds, however large, as they are doing at the Fairbanks and Paint River, if not fully assured of the merchantable quality and value of the probable product.

A small plant of machinery was on the ground, a duplicate of that at the Fairbanks, so certain was the management of getting the ore in the shaft. This has no doubt been set up ere this, and it is more than probable that the mine will be ready to ship ore by the time the spur track to the Fairbanks, which will give it shipping facilities, is completed. C. Y. Roberts, an experienced practical miner, is superintendent.

THE YOUNGSTOWN MINE

presents the largest show of ore of any in the immediate vicinity of Crystal Falls, though not as far advanced in development as some of the others. The tract embraces the east half of the south-east quarter of section 19, town 43, range 32, the fee of which is owned by Guido Pfister, Angus Smith, and others, of Milwaukee, by whom it has been leased to the Youngstown Iron Mining Company, which at the time of the writer's

visit to the mine had not been fully organized. The surface explorations show ore extending over a length of 1,200 feet, and, so far as known, 45 feet in width. The belt lies in low ground, at the base of a range of hills to the south of it, the trend being east and west. The ore is what might be called a hard hematite, averaging well in metallic iron, but like the other ores of this district too high in phosphorus for Bessemer purposes. At the time of the writer's visit a force of men was engaged in stripping the deposit at the point where test pits showed 45 feet of ore, about 10 feet of the ledge having been uncovered, and showing nothing but clean ore. The ground is very wet, and being but recently covered with a dense growth of timber, the work was being prosecuted with much difficulty.

By far the most important discovery, however, is that made with the diamond drill, which reveals the fact that there are two distinct, and apparently very large, veins or lenses of ore lying parallel with each other. From a point 100 feet south of the outcrop now being stripped, two holes were bored, north and south, each at an angle of 45 degrees, the one to the south passing through 105 feet of ore, and thence continuing 38 feet in the slate. In the other the drill, starting from the same point and boring in a directly opposite direction, cut 11 feet of ore, and after passing through 150 feet of rock again struck ore, in which it continued 149 feet. One of these drill holes was undoubtedly bored with the dip of the formation, and, perhaps, neither one shows the exact thickness of the ore body; nevertheless they fully warrant the new company's belief that it has one of the largest ore deposits ever yet found on the upper peninsula. Not enough work has yet been done to determine the dip of the formation, but it is more than probable that the 149 feet of ore cut by the diamond drill belongs to the deposit now being stripped, and which is 45 feet wide on the surface. Altogether, the Youngstown promises to develop into a mine of very large proportions, and the company is fully justified in the large outlay and extensive preparations it is making for permanent work in the future. The mine will be furnished with shipping facilities by a half mile extension of the C. & N. W. R'y from the Crystal Falls mine, which is now nearly ready for the iron. F. P. Mills, Jr., formerly mining engineer and assistant-superintendent at the Cleveland mine, and a young man of rare ability in his chosen vocation, is superintendent.

THE UNION MINE,

more generally known as the Shelden-Shafer, is in the north half of the north-west quarter of section 31, town 43, range 32, the fee of which belongs to the Ransom Shelden estate and J. F. Shafer, by whom it has been leased for a term of years to the Union Iron and Steel Company, of Chicago. Work was commenced last summer in a vein or lens of ore which appears to carry a width of about 20 feet, and at the time of the writer's visit this had been worked out to a depth of about 50 feet, and for a length of, say, 150 feet, there being all the way from 7,000 to 10,000 tons of ore in stock-pile. The trend of the formation appears to be from north-east to south-west, with a scarcely perceptible dip to the north-east. The ore is what is denominated in the Marquette district a hard hematite, and looks as if it might average from 60 to 63 per cent. in metallic iron. Stripping was in progress for an extension of the workings to the north-east, while test-pits show an extension of the lens several hundred feet in the opposite direction. Work was in progress on a branch railway track some two miles in length, and if this is completed in time to permit its shipment, the Union can be counted on for a product of at least 15,000 tons the present year. W. H. Watters is agent, and Captain Bartle superintendent.

THE MASTODON MINE

is located in the south-east quarter of the north-east quarter of section 13, town 42, range 33, the fee of which belongs to the canal company, the Mastodon Iron Company being lessee for a term of years. Work was commenced in the outcrop discovered by Jack Armstrong about three years ago, and which presented the appearance of a small island protruding above the level of the swamp, by which it is surrounded on all sides. From this outcrop, at the time of the writer's visit, about 2,000 tons of ore had been mined—the best and most uniformly clean that is to be seen at any of the mines in the immediate vicinity. About 50 feet north of the outcrop a shaft was down about 50 feet in ore of the same quality, while another was sinking at a point 150 feet north-west, where the drill bored 10 feet into ore. To the south-west of the outcrop some 300 feet the drill bored into ore, and at this point another shaft will be sunk during the summer. All that can be said with certainty concerning the Mastodon, is that the work thus far done warrants the be-

lief that the deposit is a very large one; it is too early to venture anything more than a guess as to the trend and dip of the formation. It is enough to say that the report set afloat some time ago to the effect that the outcrop was a mere boulder, and later still that the deposit was nothing but a "wash," is the silliest kind of nonsense. The fact that the ore has been found in the shaft to the north and at the other points mentioned refutes the idea that the outcrop is a boulder, while the character of the ore precludes that the possibility of its being what is denominated a "wash." The ore is a hard red hematite, very nearly approaching the standard of first-class red specular, and will enter the market with no other disadvantage than that of being too high in phosphorus for Bessemer. The writer will miss his guess if the Mastodon does not rapidly develop into a very productive mine. It is not probable, however, that the mine will be supplied with shipping facilities in time to be able to get away any of its product the present season.

The Mastodon company is officered as follows:

President—EDWARD BREITUNG;

Secretary and Treasurer—JOSEPH AUSTRIAN.

Capt. Richard Polkinghorn, an experienced iron miner, is superintendent.

THE MANHATTAN

is the property in leasehold of the Manhattan Iron Company, the officers of which are as follows:

President—EDWARD BREITUNG;

Secretary and Treasurer—J. H. OUTHWAITE.

The tract, which is the north-east quarter of the south-east quarter of section 13, town 42, range 33, is owned by S. L. Smith and T. B. Brooks. It adjoins the Mastodon forty on the south, and though as yet nothing of particular value has been found, the chances are most excellent for the development of a paying mine.

THE GREAT WESTERN

is the name of a company recently organized for the purpose of developing the east half of the south-west quarter of section 21, town 43, range 32, the east half of which is owned by the Canal Company, and the other half by Guido Pfister, trustee. The officers of the company are:

President—STEPHEN C. HALL;

Vice President—JULIAN M. CASE;

Secretary—S. D. HOLLISTER;

Treas. and Gen'l Supt.—GEO. RUNKLE.

Some test pits sunk on the west half of the tract show ore of excellent quality, and the indications are all favorable to the development of a good mine. It is intended to push the work of development as rapidly as possible, but as yet nothing can be said of the property except that the prospect is a good one.

This concludes the list of properties in the Crystal Falls region, if we except a number of explorations now in progress, some of which are said to be promising, but none which are far enough advanced to bring them within the scope of this review. The country is full of exploring parties, and it is more than probable that several new and valuable finds may be announced in the near future; but to make a note of all these explorations would carry this review far beyond the limits prescribed for it in the beginning, besides entailing upon the writer an amount of work impossible, at this time, for him to perform.

We come now to the

IRON RIVER DISTRICT,

in which there are at present but two properties which call for the attention of the reviewer. These may, probably, be considered the most important discoveries yet made in this new iron field, in that the ore appears to be of a better quality, while the deposits are simply immense. The first of these is the

IRON RIVER MINE,

which embraces the west half of the north-west, and the west half of the south-west quarters of section 36, and the east half of the north-east quarter of section 35, town 43, range 35, the present workings being on the first named sub-division of the section. There is here a very large body of ore which can be traced by the outcrop and in test-pits for a distance of nearly a mile and a half, from north-west to south-east, following along the face of the hill which gradually rises to a height of at least 100 feet above the east bank of Iron river. The trenches and test pits show the ore belt to be at no place less than 100 feet in width, while at the only point where it has been sunk upon to any considerable depth, there is a width of 117 feet of clean ore, with no foot-wall in sight. This is shown by cross-cuts east and west from the bottom of a shaft 50 feet deep, the shaft

and drifts being all the way in ore, the miners not being able to go further in search of the foot-wall because of bad air. Opposite this shaft and cross-cuts, at the time of the writer's visit two open cuts were being carried in through the hanging-wall, on the drainage level, both of which showed clean ore in the face and bottom. These cuts will give stopes at least 40 feet in height, and, together, with others of like character, which can as readily be obtained, will ensure a very large product the first year after transportation facilities are supplied. These will be had by what is called the Iron River branch of the C. & N. W. R'y, which will connect with the Crystal Falls extension about 10 miles north of Florence, and which is now being rapidly built, the contractors expressing a determination to have it completed not later than September 1st.

It would be assuming too much to attempt other than a general description of the Iron River deposits in their present stage of development. All that can or need be said is that they are, to all appearances, simply immense as to size, while the ores—hard hematites—are unusually rich in metallic iron, very low in silica, and, being entirely free of lime, it is claimed they will make an excellent "fix," and for that reason always command a ready market at an advanced price. We have not seen the official figures, but are reliably informed that the average of some 30 analyses was a little over 62 per cent. of metallic iron. It is barely possible that the deposit may lose some of its majestic surface proportions in sinking; but they can stand a shrinkage equal to 50 per cent of their present apparent size, and yet be large enough to insure a mine which will take rank as one among the largest in the whole Lake Superior region.

This mine is the leasehold property of the Iron River company, the fee of the tracts embraced in the lease belonging to L. Stegmiller, of Escanaba, Dr. Cyr, of Negaunee, and others. The officers of the company are:

President—JOHN STAMBAUGH;

Vice President—GEO. BOYCE;

Sec. and Treas.—R. McCURDY.

J. P. Jones, a most thorough business man, as well as an agreeable gentleman, is general agent for the Iron River and Youngstown companies, with present headquarters at Florence. Jas. N. Porter is superintendent, and at the time of the writer's visit was working a force of at least 200 men, the larger part

of which was, however, employed in grading on the railroad track, two miles of which is under contract to the company, and in clearing up the site for the newly platted village of Stambaugh. He appears to be the right man in the right place, and to him as well as to Mr. Jones, the writer is indebted for many courtesies which made what would have otherwise been a most tiresome and laborious task, one of exceeding great pleasure.

About two miles north-west of the Iron River, is

THE NANAIMO MINE,

the leasehold of which embraces the west half of the south-west quarter of section 26, town 43, range 35, the fee of which belongs to D. C. McKinnon. The mine is being opened by the Nanaimo Mining company, of which John S. McDonald is president and treasurer, and John Spence secretary. This company is actively at work opening up what has every appearance of being a very large deposit of ore similar to that of the Iron River. At the time of the writer's visit the drift, which covers the ore to an average depth of about 10 feet, had been removed from an area about 50 feet square, exposing a solid body of clean ore, while the test pits showed that the stripping had not been carried half way across the deposit. These test pits, together with the stripping, show 140 feet of ore, measuring across the formation, the trend of which appears to be from north-west to south-east. A shaft was likewise down 23 feet in ore, and though the deposit has not been traced either way with the trend of the formation for any considerable distance, there is enough to be seen to warrant the confident belief that it is one of great extent. A small plant of machinery had just been set up, a dock was completed, and every preparation making for the prosecution of mine work on an extensive scale as soon as the branch railway should be completed to the mine. In the opinion of the writer it will be an easy matter for the Nanaimo and Iron River mines to mine and ship a daily product of from 800 to 1,000 tons from and after the first day the railway reaches them. The Nanaimo lies in low ground on the west bank of the river, and is not so favorably located for economical mine work as the Iron River, but except as to length, the deposit appears to be fully as large. The Nanaimo will require hoisting machinery from the very start, while at the Iron

River hundreds of thousands of tons can be quarried down and trammed out to the docks and dumped directly into the railway cars at a less cost than any other mine we know of. Thos. Luxmore, formerly at the Cambria mine, Negaunee, is superintendent of the Nanaimo.

East of the Nanaimo about half a mile, in a bend of the river, is the new village of Iron River, laid out by the McKinnon brothers, and which is rapidly being built up. Among the buildings is a very large frame hotel, and a number of stores already stocked with goods. A saw-mill near by furnishes the lumber, the boards being carted away as fast as they fall from the saw, such is the demand for it. Nevertheless, we rather incline to the opinion that Stambaugh, though a vacant site at present, will ere long become a thriving rival of its young and ambitious neighbor.

THE CHICAGOAN LAKE MINE

is in the west half of the north-east quarter of section 26, town 43, range 34, concerning which we have no information based on personal inspection, not having been able to visit the location.

We are reliably informed, however, that there is an excellent show of ore on the property, a shaft having been sunk to a depth of 52 feet, from the bottom of which a drift to the west cut five feet of red, 28 feet of banded and 45 feet of brown ore. Six average analyses of these ores ran—red ore, 50 to 55 per cent. metallic iron, 8 to 11 silica, and .005 to .027 phosphorus; brown ore, 55 to 64 metallic iron, 3 to 10 silica .035 to .060 phosphorus. The explorations are being carried on by Col. N. Boardman, of Fond du Lac, who thinks, and not without reason, that he is in a fair way to develop something of more than ordinary value.

FELCH MOUNTAIN RANGE.

Contrary to the expectations indulged a year ago, the new mines on the Felch Mountain range were not supplied with transportation facilities in time to enable them to commence shipments last fall; indeed, the iron has not yet been laid to the most easterly of these mines, though it is now announced that the line will certainly be completed to the Metropolitan, Northwestern, Hecla and Calumet not later than the 15th of September. These are the only mines on this range that are

likely to be in a condition to ship any ore by that time, or, perhaps, the present year; indeed, it is doubtful if any, except the Metropolitan and Calumet, would be able to furnish the new road any ore the present season, were it already completed, the others not having any ore in stock, or having made any preparations for mining. The Escanaba & Lake Superior R. R. is the name of the new line, though it is more commonly referred to as the Felch Mountain branch of the Chicago & Northwestern. It connects with the main line at a point eight or ten miles west of Escanaba, from whence the track is now laid a distance of 18 miles in a north-westerly direction, that being about half its length as at present located, the grading on the other half being well under way. It is, no doubt, the intention of the company to extend this line to the Agogeebic district just as soon as the developments in that region shall give reasonable certainty of a paying business, and ultimately to a connection with the Northern Pacific at some point on Lake Superior.

THE METROPOLITAN MINE

is at present in a more advanced state of development than any of the mines on this new range. The original discovery was made on the north half of the north-east quarter of section 32, town 42, range 28, which is in Marquette county; the company's (Metropolitan Iron and Land Co.) leasehold covering a compact body of 520 acres in sections 32 and 33, the fee of which is held by A. Campbell, Dr. McKenzie and others. The officers of the company are:

President—S. P. BURT;

Sec. and Treas.—R. C. HANNA;

Superintendent—JEFF DAY.

The main workings consist of a shaft in the red ore belt, which is down 60 feet, and an open pit about 100 feet south of the shaft, which shows about 20 feet of blue ore. West of the pit 65 feet a winze is down 70 feet, and connected with a shaft which has been sunk to a depth of 80 feet below the bottom of the open pit, which last is about 30 feet deep, and 25 feet square. The shaft and winze show that the first 25 feet of the lens of blue ore carries a large percentage of lime, which gives it the appearance of being rather lean and badly mixed, but it is claimed that it will work and yield well in the furnace. Under this comes a clean blue ore of a most excellent

quality. About 700 feet further west a shaft is down 65 feet in blue ore; from the bottom of this shaft a drift has been run 100 feet north through slate and ore, cutting at its north end about 8 feet of clean red ore. The ore from this shaft is not so good, apparently, as that further east, but it is thought will improve in sinking.

East of these workings about half a mile, on the north-east quarter of the north-west quarter of section 33, two shafts are going down at a distance of about 300 feet from each other. The most westerly one was down 70 feet at the time of the writer's visit, and the other but just commenced. In the west shaft the ore seemed to dip to the south, and was cut by a drift started from the shaft at a depth of 40 feet from the collar. This drift went through 9 feet of red into mixed ore; another drift from the present bottom is in ore, which, however, is not so good as that above. The east shaft is in ore, some of which is, apparently, very good; both shafts are, however, in very high and unsettled ground, and to get entirely away from which and into the clean ore it will be necessary to sink to a considerable greater depth. The trend of the formation is very nearly east and west at this point as well as on section 32, but not enough work has yet been done to determine its dip, which, however, seems to be to the north.

What is called the "new find" is on the south-east quarter of the north-west quarter of section 32, about half a mile west and a quarter of a mile south of the original workings. Here an open pit is being started in what appears to be a very large deposit of hard blue ore, which gives by analysis from 64 to 68 per cent. of metallic iron, and being, like all the other ores on this range, very low in phosphorus. The ledge had been exposed over an area of 50x160 feet, while a test shaft was down some 25 feet. The blue ore lies under from 3 to 24 feet of yellow ochre. Not enough work has been done to determine the extent of the deposit, but it presents every appearance of being a very large one; it is located on the south side of the hill, from the Northwestern; and looks to us as if it might be in a southerly fold in the formation, which on the north side of the hill dips in an exactly opposite direction. The limestone lies to the south and the sandstone on the north. We shall watch developments in this quarter with much more than ordinary interest.

No work is being done at the older workings, operations being wholly confined to sinking at what are called the east workings, and stripping and preparing to mine the new find last referred to. A new plant of machinery, consisting of three 10x12 duplex Rochester engines, with $6\frac{1}{2}$ -foot drums, is in place and ready to be set in motion whenever the management determines on a renewal of operations at the old workings, from which about 8,000 tons of ore has already been raised. A force of about 50 men is employed at present, and should the railroad be completed by the time promised, we can see no reason why the Metropolitan should not reach a product of 20,000 tons the present year.

THE NORTHWESTERN MINE

is in the north half of the north-west quarter of section 32, and adjoins the Metropolitan on the west and north. The tract is owned in fee by the Beaver Iron company, by whom it has been leased to the Northwestern Iron company, of which last the officers are as follows:

President—W. D. REES;

Vice President—EDWARD BREITUNG;

Sec. and Treas.—J. N. GLIDDEN.

No work has been done on the location since last fall, the management evidently laboring under the impression that the work of development was sufficiently advanced to insure a large and rapid production as soon as the completion of the railway to the mine should render the commencement of mining operations desirable. In this we think it has made a very great mistake, and that it will now find work to do which might better have been in the course of accomplishment during the past six months. The writer was very much astonished, on visiting the mine a short time since, to note the change which had taken place, or rather been wrought by the elements. When he visited the location in August of last year, a force of men was engaged in stripping what appeared to be a very large deposit of blue ore, on the west forty, concerning which he then wrote as follows:—" * * * Nearly an acre of drift has been removed, exposing the same area of very fine blue ore, which, however, in some places shows streaks of sand, the result, most probably, of the process of infiltration which has been going on for centuries," &c. Now he visits the mine to

find that the heavy rains have either washed all the clean ore of the so-called outcrop away, or else so mixed it with sand as to entirely change its character. In no place in the whole stripping, which he carefully examined with a pick, could he find a pound of clean ore, and in no place was any to be seen, except in a heading which had been started in the west end, and the bottom of which seems to give color to the belief that the mixed ore on the surface may be a mere capping to a deposit of clean ore underneath. The writer candidly acknowledges himself to have been deceived in regard to the character of the deposit, the top of which was apparently all clean ore at the time of his visit last year, and the management seems to have been "taken in" the same way. He is not ready to believe, however, that where there is so large an outcrop of mixed ore there is no clean ore in the immediate vicinity, but is inclined to the opinion that the latter will be found underlying the mixture of lean ore and sandstone which now shows on the surface of the outcrop. Let this be as it may, he is in no wise doubtful of the very great value of the property; and in this regard he bases his opinion entirely upon developments thus far made at other points on the company's tract, together with the very large show of ore immediately east of it, at the Metropolitan. These developments, which consist of a series of shafts and test pits, show two separate and distinct belts of ore—blue and red—extending clear across the east forty, while on the west forty there are three pits all in ore. The red ore lies north and parallel with the blue, the same as at the Metropolitan, and the last three pits referred to hold about the same relative position to the lean outcrop which has been uncovered, as the red holds to the blue ore elsewhere on the location. A cross-cut in the red ore on the east forty shows 22 feet between walls; the thickness of the blue has not yet been determined.

As it is, the company will now have to begin anew and open a mine where the management firmly believed it had already opened one, and we therefore do not look for the shipment of any ore this season, even should the railway be completed by the time promised. That it has, or rather will have, a mine, and a very large one, too, the writer affects no doubt, notwithstanding the bad feature referred to.

THE HECLA MINE

embraces the north half of the north-east quarter of section 8,

town 41, range 28. It is under lease to the Hecla Iron Company, the officers of which are:

President and Treas.—E. BREITUNG;

Secretary—BYRON D. JONES.

Explorations were carried on last year in shafts and test pits, exposing clean blue ore, at intervals, over a length of about 1,200 feet. In some places this ore is covered only by a drift of sand, and at others by from 10 to 20 feet of horizontally bedded sandstone. The trend of the formation is from north-east to south-west, and the dip to the south-east. Since last spring a diamond drill has been employed in further locating and testing the extent of the ore body, and with good results, notwithstanding some foolish work done at the start. In the two last holes bored the ore was struck at a depth of about 100 feet from the surface, the drill in one cutting 21, and in the other 18 feet of ore, making due allowance for the dip. Still other holes are being bored, the intention being to thoroughly test the ground, with a view to the proper and most advantageous location of the shafts which may be necessary when the work of opening up the mine is commenced. The ore is a very fine soft blue specular, high in metallic iron, and low in silica and phosphorus.

THE CALUMET MINE

is a most promising property, and embraces the south-west quarter of the north-east quarter, and the south-east quarter of the north-west quarter of section 8, the east forty acres lying immediately south of and adjoining the west forty of the Hecla. It is a leasehold, the lessee being the Calumet Iron Co., of which the officers are as follows:

President—A. B. CORNELL;

Secretary—GEO. H. CORNELL;

Treasurer—ROBERT MCCURDY;

Superintendent—JOHN R. WOOD.

Work was commenced in the summer of 1881, and the workings at present consist of four shafts numbered 1 to 4 from north-east to south-west. No. 1 is down 50 feet in red ore, apparently of excellent quality, and still sinking. No. 2 is 200 feet south-west of No. 1, and is down to the 2nd level—125 feet from the surface—also in red ore. A drift on the 75-foot level connects No. 2 with No. 3, the last being 130 feet further south-west, and down 75 feet. No. 4 is a new shaft which has

just been commenced 150 feet south-west of No. 3, and which is going down in ore. There are two distinct and separate lenses, one of red and the other of blue ore, which lap each other between Nos. 2 and 3—Nos. 3 and 4 both being in blue ore. In addition to these shafts and drifts, a number of diamond drill holes have been bored, the first of which cut 31 feet of ore 80 feet north-east of No. 1 shaft; the second went through 57 feet of ore at a depth of 25 feet below the bottom of the first level of No. 2, and the third cut 51 feet of blue ore at about the same depth under No. 3. It is proper to say, however, that these holes were not bored exactly at right angles with the dip, and, therefore, do not show the exact thickness of the lens. Another hole is now going down to test the ground under No. 4. The shafts cover a total length of 550 feet on the two lenses, over which distance there appears to be a continuous run of ore, with no sign of exhaustion at either end. About 4,000 tons of ore has already been raised from the shafts and drifts and in preparing stopes on the first level, and by the time the branch railway is completed the mine will be in a condition to yield a very handsome daily product. This branch will be about three miles in length, connecting with the Escanaba & Lake Superior railroad, and its completion is promised by the 15th of September, on the strength of which the management has sold 10,000 tons for this season's delivery. The machinery now in use consists of two 7x10 duplex Rochester engines with 3-foot drums, to which will be added a Lane Plant with two drums of larger size. We look for a good report from the Calumet from and after the day she is enabled to make her first shipment.

THE HANCOCK MINE

is the only property of any note in either district the writer has not personally visited since the commencement of this review. He hears nothing but good reports concerning it, however, while specimens of the ore shown him are certainly very fine. It is a leasehold, and embraces the south half of the south-east quarter of section 30, town 41, range 27, the Hancock Iron company being lessee. From all the writer can learn he is inclined to believe that the company has a very promising show of ore, and that its prospects for the development of a paying mine are most flattering.

The Menominee Mining Co. has been prosecuting explorations for more than a year past on sections 31, 33 and 35, town 42, range 29, and, it is now claimed, has struck good ore on 33. Wilkinson, Smith and Cornell are exploring on sections 34 and 36, in the same town, with a diamond drill, and are very hopeful of good results, though nothing of value has yet been found.

* *

In the east half of the south-west quarter of section 33, town 42, range 28, Wilkinson and Smith have found red ore of very fine quality, and which gives, by analysis, 65.80 per cent. of metallic iron. This ore was found in a test shaft sunk through the sandstone capping, but at the time of the writer's visit not enough work had been done to enable him to venture more than a guess as to its probable extent. On another part of the same tract the diamond drill bored through from 15 to 20 feet of red ore and yellow ochre, which fact would seem to indicate that these gentlemen are in possession of a property altogether likely to develop into one of large value. The explorations will be continued and vigorously pushed, the extent of the deposit being the only question remaining to be solved.

* *

We have now completed the list of working mines, not all of which, however, were included in the shipping list last year. A comparison of the lists show that there were only four new mines added to the shipping list in 1881, though there was an increase of 333,717 gross tons in the aggregate production. It is more than probable that not less than 25 new mines will be added to the shipping list the present year, together with a few old ones which were not wrought last year. Altogether, the iron mining industry of the upper peninsula of Michigan is in a most flourishing condition. New developments are being made in every direction, and, at the present rate of increase, it will not be many years until this region will be in a condition to furnish as much ore as is now consumed at all the furnaces in the United States. The time is not far distant, either, when the coal of Ohio, Pennsylvania, Indiana and other states, will find its way to a hundred furnaces on this peninsula, whose make will be needed to supply the wants of the great empire to the north and west of us. With railway communication to all parts of the rapidly growing

North-west, the transportation of our ores a distance of from 500 to 1,000 miles will continue only so far as they may be needed to supply the wants of the eastern and middle states—a new market will then have been opened to us, and one in which we can have no successful competitor. When that time comes the Lake Superior iron region, already the wealthiest and most profitable mining field in the Union, not excepting the gold and silver districts of the far west, will have but entered upon the path which leads to the position of still greater prosperity, wealth and renown which lies beyond.

* *

A review of the iron mining industry would be incomplete without more than a mere passing notice of the Negaunee Concentrating company's new works, now just being completed. These works, designed for the treatment, by crushing and washing, of the lean ores of the district, are located a short distance north of the C. & N. W. railway, where it passes the Jackson mine, and consist, at present, of a boiler house, engine house, and the concentrating house proper. The latter is an immense building, very substantially built, and resting against the south side of the bluff, on the opposite side of which lie Teal Lake and the Cambria and Bessemer mines. This building is seven stories in height, four of which are in the side of the bluff, while the other three tower above it. It is simply a vast net-work of heavy timbers, the whole covered with a roof of corrugated iron; it slopes upward to the north at an angle of about 15 degrees from the perpendicular, and each story has, apparently, a separate roof, the roofs presenting the appearance of terraces. Only half the main building, as originally projected, is finished; the other half will be erected after the machinery in the part already up is put into successful operation. When fully completed it will be 183½ feet long, 116½ feet wide, and 113 feet high. Large tanks, from which pipes lead to all parts of the building, and 200 buckets filled with salt water, afford ample protection against fire. The water to be used in washing the ore is obtained from pipes laid from Teal Lake to the works. A massive engine of 600-horsepower, the steam for which is supplied by three 6x18 boilers, furnishes the power for the operation of the vast net-work of machinery. The company has a contract which permits it to mine all the lean ores it may elect on the Jackson mine location,

and has a mile and a quarter of railway track laid to facilitate its operations. Over two hundred men are now employed at and around the works, but these are only a fraction of the force that will be necessary when operations are fully inaugurated.

The works were to have been started up the second week in July, and iron men generally are much interested over the result of the experiment—for experiment it really is, notwithstanding such works have proved successful elsewhere. In this expression we but voice the opinion of the management, which finds the ores of this region somewhat different from those heretofore treated by concentration, in that they are not a simple mixture of ore and rock, easily separated from each other, but lean ores carrying a large percentage of silica. Whether this silica can be eradicated to an extent sufficient to concentrate the ore up to the standard of first-class is the problem soon to be solved, and upon the solution of which in a great measure depends the permanent success of the enterprise. As we have before remarked, however, the company must have large faith or it would hardly have ventured upon the expenditure of several hundred thousand dollars in the erection of works on such an extensive scale. The process is a patented one with which none but the owners are familiar, and it is in deference to the wishes of the management that we await the result of operations before attempting a description either of the process or of the complicated machinery by which it is wrought. The works are in charge of the following officers:

General Manager—G. CONKLIN;

Superintendent—W. A. ALLEN;

Master Mechanic—F. W. GERCKE.

LAKE ANGELINE MINE.

[This paper descriptive of the Lake Angeline was accidentally overlooked in the distribution of copy, and the omission was not discovered in time to permit its insertion in the proper place.]

This mine is located on the south side of the lake from which it takes its name, and is the property of the Pittsburgh and Lake Angeline Iron company, whose estate embraces 1,376

acres, the mine being in the north half of section 15, town 47 range 27. The officers of the company are:

President—JAMES LAUGHLINS;

Secretary and Treasurer—J. H. OUTHWAITE;

General Agent—ALFRED KIDDER;

Superintendent—HARVEY DIAMOND;

The mine was opened in 1863, since which time its annual product has been as follows:

	Gross Tons.
1864.....	19,500
1865.....	20,151
1866.....	24,073
1867.....	46,607
1868.....	27,651
1869.....	35,432
1870.....	53,467
1871.....	33,645
1872.....	35,221
1873.....	43,933
1874.....	31,526
1875.....	26,370
1876.....	22,539
1877.....	19,112
1878.....	23,161
1879.....	25,321
1880.....	14,923
1881.....	18,960
Total.....	525,637

The workings at the Lake Angeline cover a length of about 1,000 feet on a lens of ore having a nearly east and west trend, with a slight dip to the north and an unmistakable pitch to the west. These workings constitute what are really two large open pits, which are separated from each other by a pillar which has been left standing from the surface, and in which the pump shaft is located. Nevertheless that part of the workings west of the pump shaft are, for better convenience, designated as Nos. 1 and 2, and the ground east of the shaft as Nos. 3 and 4, the designation having reference to the skip roads and derricks rather than to the openings. No. 4 has been entirely worked out, while in No. 3 the ore has narrowed down to a comparatively small compass, and owing to heavy falls of rock can no longer be profitably wrought as an open pit. The plan now is to go under the present bottom, from No. 2, and thus secure whatever ore may yet be found in No. 3. In No. 2 there is yet a good show of ore in the bottom, while at No. 1 there is a very

marked improvement both as to quantity and quality. There is here a body of ore of the average width of 40 feet, extending over a length of about 200 feet, with the west heading in ore, and the lens apparently making larger in that direction; the ore body in No. 2, which is simply an eastern extension of No. 1 carries a width of about 35 feet, the two together constituting an open pit about 500 feet long. In the west end the hard ore is giving way to a soft hematite of excellent quality, and it can be truthfully said that the mine, as a whole, presents a more promising outlook than at any previous period in its history. The shaft 250 feet north and west of the west end of No. 1 pit, to which brief reference was made in our last annual review, will now be utilized for hoisting purposes. This shaft was sunk through nearly 100 feet of sand drift into blue hematite, which, however, was not entirely clean. A drift south 30 feet struck clean ore, into which it had been driven, at last advices, 10 feet. The indications are that the lens either widens out very rapidly in going west, or else takes a turn to the north, as the south end of this drift is at least 100 feet north of a line drawn due west from the open pit. It is the intention to drop the shaft 40 feet, and then open up an underground mine, and that it will be one of goodly proportions is more than probable.

No new machinery, of any particular importance, has been added to the equipment the past year, and the mine gives employment to about the same number of men.

BLAST FURNACES.

A brief history of iron making on Lake Superior may not be out of place in view of the indications of a speedy revival of that industry. The building of new railways is opening up extensive forests of hard wood hitherto inaccessible, while the recently invented processes for the more economical charring of wood in retorts, by which means the amount of coal made is not only largely increased but other merchantable values equal to the coal itself, and which have hither been lost or wasted, are saved, not only enhances the value of our great hard wood forests, but promise to very materially reduce the cost of making charcoal pig. These new processes are now being adopted

at some of the furnaces, notably at the Martel, St. Ignace, and at a new one now in course of erection at Newberry, on the line of the D., M. & M. R. R., about 90 miles east of Marquette.

The history of iron making on Lake Superior is briefly as follows: In the summer or fall of 1846, one year after the discovery of the Jackson Mountain by Mr. Everett and his party, the Jackson Company undertook the erection of a forge on the Carp river, about three miles east of Negaunee. The building of the forge was intrusted to Wm. McNair, who was sent here as agent for the company. He had never seen a forge, and did not succeed in accomplishing anything toward its erection till the following year. In July, 1847, Ariel N. Barney, and his brother-in-law, Aaron K. Olds, arrived at the mouth of the Carp, having been sent up by the company. They were both practical iron makers, and expected to find the forge nearly ready for work. In this they were disappointed, as nothing had been done save that a few timbers had been hauled upon the ground; they soon discovered that McNair knew absolutely nothing about the business he had undertaken, and it was not long until Mr. Barney was empowered to go on and build the forge, and to him really belongs the credit of having built and put into operation the first iron manufacturing establishment on Lake Superior.

The first bloom was made on the 10th day of February, 1848, by Mr. Olds, and was hammered into bar iron by Mr. Barney. This is the correct date of the first manufacture of iron on Lake Superior.

In May of the same year, Messrs. Barney, Olds, and one or two others, started in a small boat for the Sault, taking with them about 300 lbs. of bar iron, among it the first bar made at the forge. This iron was taken to Jackson, Mich., and there exhibited as a specimen of what could be done on Lake Superior.

The forge continued in operation till sometime in 1852, when it was abandoned. It never paid the interest on the money invested, but having served the purpose of a thorough test of the Jackson ore, the company very wisely concluded to abandon it, and devote the whole of their capital and energy to the development of their mines.

Another forge was built at Marquette, just south of the shore end of the Cleveland dock, by a Worcester (Mass.) company, in 1849, under the direction and superintendence of

A. R. Harlow, Esq. It was destroyed by fire in 1853, and was never rebuilt. Two other forges were subsequently built at Forestville and Collinsville.

The first pig iron from Lake Superior ore was made by S. R. Gay, at the Collins forge. It was made as an experiment, in the forge chimney, which had been converted into a temporary stack. The result confirmed Mr. Gay in his determination to build a blast furnace, which he afterwards did.

The first blast-furnace on the upper peninsula—the Pioneer—was built at Negaunee in 1857, and made her first iron in April, 1858. Since then twenty-four more stacks have been blown in, not more than a dozen of which, however, have ever been in blast at one time, if, indeed, in any one year. Two of these were completed and put in blast last year, another is now building, and still others talked of or projected. The Collins, Bancroft, Escanaba and Cliffs have been dismantled and abandoned; the Morgan, Champion, Greenwood and Bay were destroyed by fire and never rebuilt; the Michigan, Grace, Northern and Munising have not been in blast for a number of years, though fully equipped, and needing comparatively few repairs.

TABULAR STATEMENTS.

The following table exhibits the output of the Lake Superior iron mines in 1881, together with the approximate value of the same in the market:

NAME OF MINE.	GROSS TONS.	VALUE.
Argyle	4,584	\$ 43,548 00
Barnum	27,883	264,888 50
Bay State	583	3,166 50
Bessemer	16,718	91,949 00
Boston	14,824	140,828 00
Cambria	19,245	106,122 50
Champion	145,427	1,454,270 00
Chapin	134,521	1,076,168 00
Cheshire	7,449	40,969 50
Chicago	5,531	30,420 50
Cleveland	198,569	1,886,405 50
Columbia	11,158	89,264 00
Commonwealth	97,410	608,812 50
Conrad	355	3,372 50
Cornell	11,816	94,528 00
Curry	17,534	149,038 00
Cyclops	12,644	101,152 00
Dalliba	10,986	60,423 00
East Champion	3,408	27,264 00
Emmet	648	3,564 00
Florence	100,501	552,755 00
Forest City	1,895	10,422 50
Foster	3,011	16,560 50
Goodrich	10,245	69,154 00
Hewitt	4,352	34,816 00
Humboldt	26,302	249,869 00
Jackson	118,939	1,024,500 50
Keel Ridge	19,011	152,088 00
Lake Angeline	18,060	123,720 00
Lake Superior	262,235	2,185,576 50
Ludington	3,374	26,992 00
McComber	28,051	154,280 50
Michigamme	57,272	544,084 00
Milwaukie	31,635	173,992 50

Mitchell.....	21,146	116,303 00
National.....	24,833	235,913 50
New York.....	50,074	475,702 00
Norway.....	137,077	891,000 50
Pendill.....	13,586	74,723 00
Perkins.....	60,406	483,248 00
Pitts. & Lake Superior.....	39,276	333,846 00
Quinnebec.....	43,711	349,688 00
Republic.....	233,786	2,337,860 00
Rolling Mill.....	1,668	9,174 00
Saginaw.....	30,793	292,534 50
Salisbury.....	43,690	240,295 00
Section 12.....	13,243	72,842 00
Spurr.....	2,746	26,087 00
Stephenson.....	10,856	86,848 00
Sterling.....	4,702	44,669 00
Swansey.....	7,562	41,591 00
Taylor.....	9,449	51,969 50
Vulcan.....	85,274	682,192 50
West Republic.....	7,354	69,863 00
Wheat.....	9,040	76,840 00
Winthrop.....	43,630	239,965 00
Miscellaneous.....	1,237	6,803 50
Total iron ore.....	2,321,315	\$18,834,923 00
QUARTZ.		
Carp River.....	8,460	42,300 00
Lake Fairbanks.....	6,560	32,800 00
Total quartz.....	15,020	75,100 00
Total ore and quartz.....	2,336,335	\$18,910,023 00

The following table shows the product of the Lake Superior charcoal furnaces in 1881, together with its value in market:

NAME OF FURNACE.	Gross Tons	VALUE.
Pioneer.....	17,030	\$ 510,900
Menominee.....	8,336	250,080
Florence.....	714	21,420
*Carp River Iron Co.....	10,253	307,590
Jackson.....	4,680	140,400
Deer Lake.....	7,831	234,930
Martel.....	4,109	123,270
Total.....	52,953	\$1,588,590

*Three stacks—Carp River, Pacific and Excelsior.

The following table shows the aggregate product of the working mines of this district, from 1856 to 1881, inclusive—a period of 26 years:

<i>Name of Mine.</i>	<i>Gross Tons.</i>
Argyle.....	228,091
Barnum.....	487,906
Bay State.....	14,799
Bessemer.....	87,023
Boston.....	31,302
Cambria.....	55,703
Champion.....	975,903
Chapin.....	169,077
Cheshire.....	87,179
Chicago.....	15,510
Cleveland.....	2,329,064
Columbia.....	82,033
Commonwealth.....	107,053
Conrad.....	4,794
Cornell.....	42,557
Curry.....	52,188
Cyclops.....	79,198
Dalliba.....	10,986
Emmet.....	66,003
East Champion.....	64,264
Florence.....	114,644
Forest City.....	1,895
Foster.....	108,949
Goodrich.....	41,606
Hewitt.....	4,352
Humboldt.....	485,495
Jackson.....	2,195,162
Keel Ridge.....	30,507
Lake Angeline.....	525,697
Lake Superior.....	2,666,456
Ludington.....	12,190
McComber.....	252,345
Michigamme.....	443,247
Milwaukie.....	45,718
Mitchell.....	75,731
National.....	91,685
New York.....	974,489
Norway.....	416,137
Pendill.....	34,094
Pittsburgh & Lake Superior.....	237,392
Perkins.....	123,067
Quinnesec.....	164,026
Republic.....	1,425,399
Rolling Mill.....	221,814
Saginaw.....	420,774
Salisbury.....	237,842
Section 12.....	18,601
Spurr.....	146,612
Stephenson.....	34,123

Sterling	5,499
Swanzy	7,562
Taylor	10,559
Vulcan	272,617
West Republic	7,354
Wheat	16,444
Winthrop	256,300
Quartz and mines not now working	525,426
Total	17,642,443

The following table shows the aggregate product of all the furnaces that have been built and put into operation on the upper peninsula :

<i>Name of Furnace.</i>	<i>Gross Tons.</i>
Pioneer (two stacks)	171,592
Northern	15,059
Collins	41,997
Michigan	41,531
Greenwood	40,202
Bancroft	54,618
Morgan	57,573
Champion	31,048
Deer Lake (two stacks)	37,518
Jackson (two stacks)	118,411
Bay (two stacks)	50,706
Munising	28,312
Grace	11,346
Escanaba	8,650
Carp River Iron Co. (three stacks)	75,685
Menominee	45,776
Cliff	8,209
Florence	714
Martel	4,109
Total	843,251

The following is a statement in gross tons of the aggregate product of the mines and furnaces for each year since 1853, together with the value of same:

YEARS.	Ore.	Pig Iron.	Ore and Pig.	VALUE.
1856*	86,319	86,319	\$ 258,957
1857.....	25,646	25,646	76,938
1858.....	22,876	1,629	24,505	133,788
1859. *	68,832	7,258	76,090	575,529
1860.....	114,401	5,660	120,061	736,496
1861.....	114,258	7,970	122,228	775,832
1862.....	124,169	8,590	132,759	984,977
1863.....	203,055	9,813	212,868	1,416,935
1864.....	247,059	13,620	260,679	1,867,215
1865.....	193,758	12,283	206,041	1,590,430
1866.....	296,713	18,437	315,150	2,405,960
1867.....	465,504	30,211	495,715	3,475,820
1868.....	510,522	38,246	548,768	3,992,413
1869.....	639,097	39,003	678,100	4,968,435
1870.....	859,507	49,298	908,805	6,300,170
1871.....	813,984	51,225	865,209	6,115,895
1872.....	948,553	61,195	1,009,748	9,188,055
1873.....	1,195,234	70,507	1,265,741	11,395,887
1874.....	985,488	86,494	1,071,982	7,592,811
1875.....	910,840	81,753	992,593	5,788,763
1876.....	993,311	61,911	1,055,222	5,397,785
1877.....	1,025,129	29,685	1,054,814	5,299,598
1878.....	1,125,093	17,404	1,142,497	6,884,432
1879.....	1,414,182	39,583	1,453,765	11,413,114
1880.....	1,987,598	48,523	2,036,121	19,457,427
1881.....	2,321,315	52,953	2,374,268	20,498,613
Total...	17,642,443	843,251	18,485,694	\$138,592,275

* And Previous.

COPPER.

The copper district of Lake Superior embraces the counties of Houghton, Keweenaw, Ontonagon and Isle Royale. The following table shows a list of the mines wrought in 1881, together with the product (refined copper) of each, and the aggregate market value:

NAME OF MINE	Net Tons.	Pounds.	Market Value.
Adventure.....	3	1,500	\$ 1,368.75
Allonez.....	736	1,007	268,823.67
Arcadian.....	1	367	431.97
Ash Bed.....	6	1,984	2,552.08
Atlantic.....	1,264	9	461,361.65
Aztec.....	4	874	1,619.50
Calumet & Hecla.....	15,680	781	5,723,342.53
Central.....	709	465	258,869.86
Cliff.....	39	1,382	14,487.21
Concord.....	14	849	5,264.95
Conglomerate.....	193	91	70,461.60
Copper Falls.....	334	1,121	122,114.58
Evergreen Bluff.....		968	176.66
Flint Steel River.....	2	1,402	985.86
Franklin.....	1,338	1,932	488,722.59
Grand Portage.....	13	264	4,793.18
Hancock.....	235	1,897	104,371.20
Huron.....	127	515	46,448.98
Isle Royal.....	23	1,308	8,633.71
Madison.....		1,534	279.95
Mass.....	233	1,684	85,352.33
Minesota.....	12	227	4,421.43
Minong.....	7	1,397	2,809.95
Nonesuch.....	59	1,061	21,728.63
Ogima.....	8	776	3,061.62
Osceola.....	2,089	1,976	762,845.62
Pewabic.....	938	244	342,414.53
Phoenix.....	204	1,357	74,707.65
Quincy.....	2,753	848	1,004,999.76
Ridge.....	117	1,606	42,998.10
Shelden-Columbian.....	5	31	1,830.66
Star.....		758	138.33
St. Clair.....	62	1,493	22,902.50
Total.....	27,274	1,708	\$9,955,321.59

The following table shows the product (refined copper) of the Lake Superior copper mines for each year since 1854, together with the average value:

YEAR.	Tons.	Pounds.	Value.
1854 and previous.....	6,992	1,727	\$ 3,146,400
1855.....	2,904	1,334	1,586,160
1856.....	4,108	1,392	2,218,320
1857.....	4,765	830	2,382,500
1858.....	4,579	1,916	2,129,235
1859.....	4,463	1,905	2,239,591
1860.....	6,034	375	2,654,960
1861.....	7,519	837	3,487,995
1862.....	6,793	328	3,634,255
1863.....	6,492	1,344	4,415,600
1864.....	6,245	1,965	5,870,300
1865.....	7,179	583	5,635,515
1866.....	6,875	63	4,629,375
1867.....	8,763	1,607	4,442,811
1868.....	10,467	124	4,940,424
1869.....	13,312	1,300	6,230,016
1870.....	12,311	849	5,096,752
1871.....	12,873	349	5,728,485
1872.....	12,276	1,523	7,979,400
1873.....	15,045	1,505	8,726,100
1874.....	17,166	1,389	8,009,356
1875.....	18,019	1,497	8,180,626
1876.....	19,135	997	7,998,430
1877.....	19,513	671	7,327,888
1878.....	20,845	1,266	6,920,540
1879.....	21,425	1,529	7,327,350
1880.....	24,869	367	9,947,673
1881.....	27,274	1,708	9,955,321
Total.....	328,328	1,370	\$152,571,458

These Copper tables have been compiled from figures kindly furnished by Mr. Wright, Commissioner of Mineral statistics.

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It was the writer's intention to embody in this review a detailed description of the several copper mines enumerated in the foregoing tables, but being himself unacquainted with copper mining, he sought in vain to secure the aid of some person competent to perform the work, until it was too late to undertake it himself. Neither has he been able to collect the statistics of the lumber trade, nor yet to visit the newly revived slate-

industry of Baraga county; indeed, to visit, inspect, and report upon the iron mines within the time consumed in the preparation of the foregoing pages, is alone all that one person might reasonably be expected to accomplish. The reader must, therefore, be content with simply a general reference to the other great industries of the upper peninsula. With a population not to exceed, probably, 100,000, the upper peninsula can make a showing which, we confidentially believe, can not be made by any other section of the country of the same area or population. Add to the value of its iron and copper product, that of its lumber, omitting the earnings of its foundries, machine shops and all other industries, and we have no less than *thirty-five millions of dollars* as its gross earnings in 1881, to be still further increased to the extent of several millions the present year. We truthfully boast the possession of the largest and richest iron mines in the world, and there does not exist anywhere any gold or silver mine of such enormous wealth producing capacity as Lake Superior's famous copper mine, the Calumet & Hecla. This last has returned to its owners no less than \$21,350,000 in dividends, on an original investment of \$200,000, has a surplus fund of several millions in its treasury, and bids fair to more than repeat in the future its record of the past.

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With the foregoing record before him, how can the capitalist hesitate where and how to invest his surplus funds? Iron mining is a legitimate business, not a doubtful speculation; there have been no losses not directly traceable to bad management, or a wretched lack of judgment in the selection of property in which to invest. No where, and in no other business, is the man of means so certain of a handsome return on the amount invested; the stocks of our principal mines are as nearly an absolute security as a government bond, while yet returning to the holder ten-fold as much annually in the way of interest. Men who have squandered hundreds of thousands, nay millions, of dollars only to pauperize themselves in speculative gold and silver mining, could easily have made immense fortunes by investing half the amount thus thrown away, in the much more legitimate business of mining iron or copper on Lake Superior—a region the mines of which return to their owners annually *a larger amount of profit than is*

yielded by all the gold and silver mines of the United States! Indeed, no other region of the same extent and population—no matter what its industries may be—can present a showing of profits which will at all compare with exhibit which can truthfully be made in behalf of the iron and copper mining industries of the upper peninsula of Michigan—and to prove the truth of the assertion the author of this little book respectfully invites a comparison of figures, past and present!



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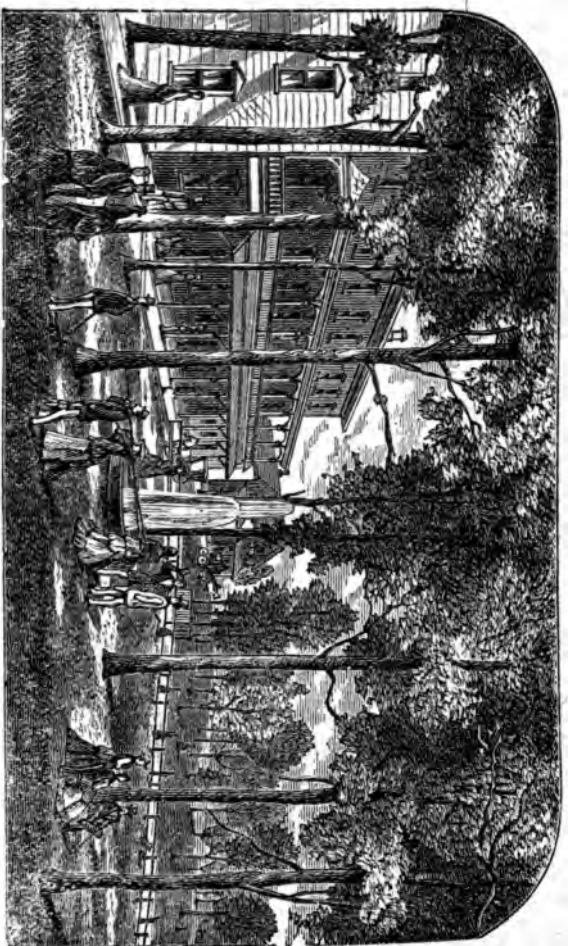
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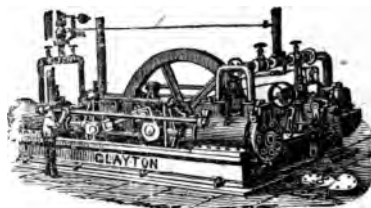
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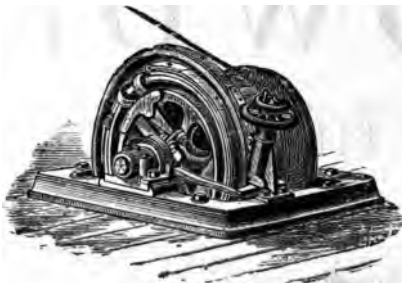
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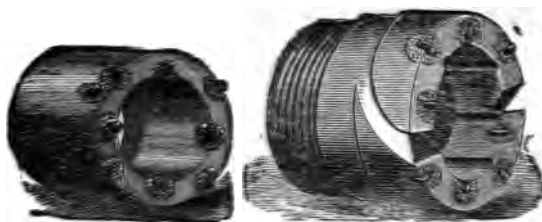
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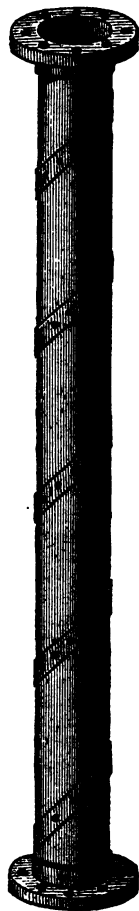
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